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TECHNOLOGY TRANSFER PROGRAM (TTP)

FINAL REPORT

STANDARDS

# STANDARDS

## VOLUME 2 APPENDICES

Prepared by:

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in conjunction with:  
IHI Marine Technology, Inc.

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APPENDIX A

STANDARDIZATION

AND

MODULARIZATION IN SHIPBUILDING

UNIVERSITY OF MICHIGAN  
SHIPBUILDING SHORT COURSE

October 27-31, 1980

STANDARDIZATION AND MODULARIZATION IN SHIPBUILDING

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A P "

FP

Transverse Frame Space L=Lbp					
Space (mm) L(m)	Spa	Se	Sm		Spf
			Tanker & Ore C.	Bulk C. Cargo	
90 ≤ L < 100	600	700	3,800	not	2,000- 2,400
100 ≤ L < 120	700	750		stand-	
120 ≤ L < 150				ardized	
150 ≤ L < 200	800	800	4,600	800	2,440- 3,000
200 ≤ L < 250			4,800		
250 ≤ L < 290			5,000		
290 ≤ L < 320	900	900	5,300		
320 ≤ L			5,100 (Hor.Main)		
					3,000- 3,300

Longitudinal Space B=Breadth mld.		
Space (mm) B (m)	Longl. Space	
	Deck & Bottom	Side
B < 16	not Standardized	
16 ≤ B < 23	750	750
23 ≤ B < 32.2	800	800
32.2 ≤ B < 54.5	850	850
54.5 ≤ B	940	850

Figure 3. Standard frame space modules.

But , in spite of these obstacleks, the shipbuilders have tried, slowly but steadily, to introduce standarixation into shipbuilding. Looking through the past record of SNAME's, it is very interesting to discover that "standardization" for shipbuilding had been discussed as early as 1900. Even then, the concept of standard ships had been proposed, and suggestions were made to standardize ships in the same manner as automobiles, giving them nicknames like "Ford ships," "Buick Ships,"<sup>1</sup> Dodge ships,' and so on.

This concept of standard ships did come to realization in the two World Wars, especially during World War II when the United States played the major role in mass-producing thousands of freighters and tankers, well known as "Liberty ships," "Victory ships," and "T2's". Japan also produced series of "wartime standard ships," ranging up to 10,000 DWT. These ships were highly rationalized in design and were mass-produced simultaneously in several shipyards to fulfil the huge demand of tonnage required in wartime transportation.

But after the war, the concept of standard ships gradually receded. The requirements for individual ship designs became so diversified and sophisticated that the shipbuilder had to retreat to the traditional "tailored" design to satisfy the various requirements of their clients. But in the early 1960's, the booming demand for new ship construction offered a good opportunity to the shipbuilders to reintroduce standardization to rationalize and improve their productivity.

Naturally, the standardization started from components and then expanded to modular units, systems, and eventually to whole ship designs.

In the late 1960's, most leading European and Japanese shipyards presented series of standard ships, mostly tankers, bulk carriers, and multi-purpose cargo ships, into the market. But since the oil crisis, triggered by the Suez War in 1973, a deep depression in the shipping market again reduced the demand for standard ships.

It is quite obvious that standard ships will be meaningless to the shipyard unless they have sufficient orders to build them continuously in series. But this does not mean that standardization must be wiped out from shipbuilding. Irrespective of the ship's type, size, or sophistication, there are many components, equipment groups, or systems which still have similar or common features that could be standardized or modularized.



## II. BASIC CONCEPT OF STANDARDS AND MODULES

The terms "standard" and "module" used in this text have the following meaning:

∴ A "standard" is a basic element, component, or unit used for hardware, or, a basic rule or criterion used for software, that should not be changed, irrespective of the system they belong to.

A "module" is a basic group or formation of standard and optional components that could be used as a complete unit or could be replaced partially by other standard or optional components. In other words, a "module" is an integrated, predetermined group of components and/or output data which could be retrieved by a simple input code.

Basically, a "standard" is a fixed concept which should be strictly followed by the designer or worker. It identifies the quality and the design philosophy of the product and it could be classified into:

. Material standards, which include:

- Raw material, such as steel plates, sections, pipes, etc.
- . Basic components, such as bolts, nuts, flanges, valves, pipe pieces, gaskets, cables, ropes, paints, etc.
- . Standard fittings and units, such as anchors, chains, doors, ladders, mooring fittings, cargo blocks, furnitures, pumps, motors, etc.

A material standard may refer to an item that is manufactured, or to one that is purchased as a finished product.

• Engineering standards, which include:

- " Design standards, such as design criteria, specifications, etc., for systems or hardware.
- . Production engineering standards, such as procedures and processes of lofting, fabrication, welding, outfitting work, etc.
- . Inspection standards, such as accuracy, testing methods and procedures, quality control, etc.

On the other hand, "modules" are more diversified and flexible than "standards." A module provides basic system models, units, machinery and



### III. STANDARDIZATION IN THE JAPANESE SHIPBUILDING INDUSTRY

The Japanese shipbuilding industry fully realized the necessity of establishing shipbuilding standards in the late 1940's when Japanese shipbuilders began to revive and strengthen their shipbuilding capacity. Under the auspices of the Society of Naval Architects of Japan, (SNAJ) , the major shipyards jointly formed several working groups and committees to establish design standards, hull construction standards, outfitting standards, testing and inspection standards, etc., as a common basis for design and production. In parallel, national marine standards were established by the Japan Marine Standards Association in coordination with the shipbuilding and pertinent marine industries, and the standards thus established formed part of the Japanese industrial Standard (JIS), enacted by the Ministry of Transport. JIS standards cover various marine components, equipment, machinery, electric and electronic appliances, test procedures, etc., as well as materials and components that could be used in common with other industries.

Marine JIS standards are classified into the following:

- Fittings (about 190 items), covering Various mooring fittings, anchors, anchor cables, davits, derricks, hatch covers, manholes, steel doors, round scuttles, windows, ventilators, ladders, life boats and davits, galley equipment, pipe fittings, cargo blocks, navigation equipments, etc.
- Engines and Valves (about 190 items), covering design criteria, material specifications, and test codes for various machinery, instruments, valves, strainers, filters, pipe flanges and joints, tools, etc.
- Electric Appliances & Navigational Instruments (about 110 items), covering various electric lamps, lights, projectors, batteries, signal lamps, engine telegraphs, switches, distribution boards, etc.

These JIS standard fittings and components are manufactured by specialized manufacturers in accordance with JIS specifications and, after testing and type approval, these manufacturers are authorized to distribute their products stamped with a "JIS" mark.

In addition to these national standards and voluntary consensus standards of the marine industry, most shipyards have established their own supplementary standards in areas which are not covered by the former two categories, mainly, to rationalize production processes and facilities. Figure 1 shows a sample of in-house standards currently adopted by IHI.

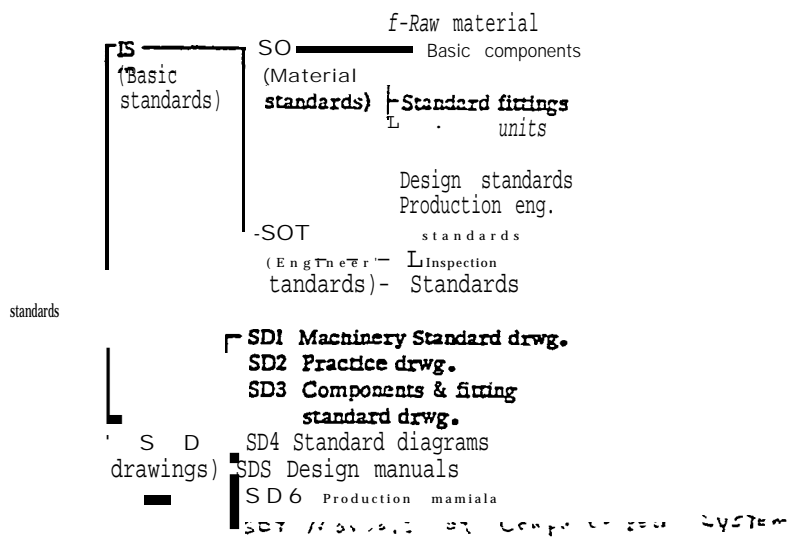
These standards are basically organized into two main categories: "IS," which are "Basic Standards," and "SD," which are the "Standard Drawings."

"IS" includes basic standards which must be strictly obeyed by the designers or the workers, and is further divided into "Material standards (SO)" and Engineering standards (SOT)."

In addition to the "IS" basic standards,, "SD" provides the standard or guidance drawings for machinery and outfitting layouts, basic system modules, manuals and practices, etc., which can be utilized in routine design and production work. Besides the basic modules, "SD" allows some flexibility in application to meet individual requirements. Figure 2 shows the number of standards currently adopted in IHI's shipbuilding operation.

These standards are controlled and up-dated by special control groups . in the design department. Up-dating is mainly based on feedback from service engineers aboard ships during the guarantee period, and also from the production line for improvement in productivity.

The number of standards is kept to a minimum by identifying and canceling those which are found to be obsolete or not worth keeping.



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#### IV. PROCEDURES OF STANDARDIZATION AND MODULARIZATION

*Standardization* is a tedious and cumbersome job that requires full investigation of the ships' systems and their features to establish good and useful Standards. In a sense, "standards" are often misconceived as "cheap and poor quality" products, but this is not the way "standards" should be established. Standard materials should be of high quality and durable to assure a trouble-free and reliable product. The performance of these standards should be observed incessantly and improved or updated to debug any defects or to keep up with the state-of-the-art. It is also important to keep the number of standards to a minimum.

The first step to standardization is to identify basic material, components, and fittings that are commonly used in all types of ships. Most raw material specifications are specified by national standards or classification society rules, so it is only necessary to standardize sizes or thicknesses, based on manufacturers' standard market products, considering the frequency of usage, shop facilities, storage, etc. Components or fittings that are standardized and readily available in the market can be used directly as in-house standards. This concept can also be extended to basic machinery or equipment, such as pumps, motors, lifeboats, hatch covers, etc., selected from makers' standard models which are proven to be reliable from past experience. In this case, at least two manufacturers' models of similar characteristics should be selected to allow flexibility in purchasing.

Standards for design and engineering should be systematized and categorized into systems and/or production processes. Standard specifications and calculation formulae or sheets can be used to unify the design criteria, quality, functions, and work practices of the systems. Supplementary data and manuals to support these standards are also necessary to identify the rationale of the standardized items. This assists the user in understanding the logic of the various standards, and in extrapolating to applications which are beyond the standards. The next step is to expand these standards into modules.

The ship's hardware consists of numerous systems involving thousands of structural and mechanical components. But most of these components can be

divided into a number of groups having similarity or commonality in their shapes, sizes, or characteristics.

A ship **construction** can also be categorized into several functions, such as hull structure, exterior and interior hull outfitting, machinery outfitting, and electrical outfitting. Also, the design phase of each category can be divided into "functional design" and "arrangement design."

The functional design phase defines the system to perform the required functions, and can be sub-divided into:

- (1) Determination of particulars.
- (2) *System* design and function checks.
- (3) Diagrammatic and skeleton design.

The arrangement design phase develops the physical aspects of the system as defined by the functional design. Arrangement design can be divided into the following steps:

- (1) Allocation of machinery and equipment (such as general arrangement and machinery arrangement).
- (2) Detailed structures, piping *arrangement*, access arrangement, etc., based on general arrangement and machinery arrangement plans.
- (3) Development of working plans, such as composite plans, fitting plans, fabrication and manufacturing drawings, etc.

In modularizing the design, the systems involved must be carefully analyzed in relation to the design steps, and separated into "invariable" and "variable" elements. The "invariables" can then be formed into "standard modules" which will be mostly composed of Standard components described previously. The "variables" should be left flexible and easily changeable to meet specific design requirements. A series of "optional modules" could also be pre-established to serve as "variables."

so by standardizing the components and combining them in suitable modular units, it is possible to establish a series of standard modules which can be applied in various systems having similar functions or characteristics. In order to meet the specific requirement of a client, these standard modules can be replaced or supplemented by other standardized optional modules. By this means, a *tailor-made design is available with minimum effort* without interfering with the standardization principle.

This way of standardization has been successfully applied in the automobile industry. In buying a new car, one can select the style among several brands using the same chassis, two doors or four doors, v6 or v8 engine, manual or automatic transmission, interior and exterior finishings, power windows, remote locks, AM/PM radios, stereos, etc.



## V. TYPICAL APPLICATIONS OF STANDARDS AND MODULES

Standards and modules are not only useful as the basis of design, but are also useful as the basis for purchasing, material control, production processes, and quality control, integrated as a total system. The introduction of large computers will serve an important role in integrating the whole system.

The following are some typical applications of standards and modules in various stages from design to production.

### 5-1. BASIC DESIGN

At the basic design stage, the work is mostly concentrated on functional design. Therefore, engineering standards, specifically design standards, will play the predominant role at this stage.

standardization of ship construction specifications, hull-form characteristics, design criteria for various systems, structural analysis methods, calculation forms, etc., will insure consistency in design philosophy and ship's quality.

Standard modules will also help the designer to decide system arrangements speedily without making serious errors.

#### A. Frame Spacing and Hull Dimensions

The first example is the application to hull design which can be standardized or modularized in two ways. One is the "Frame space module" applied to longitudinal and transverse framing, and the other is the "Base ship module" which embodies modularization of hull dimensions.

Frame Space Modules. Figure 3 shows a list of "frame space modules." In the past, most designers selected the frame space for each ship design to obtain minimum steel weight. But the saving in steel weight is now not significant enough to contribute in reducing the ship's cost. On the contrary, soaring labor costs have become a more serious problem. So the philosophy has changed in recent years to reduce labor manhours radically by introducing mechanized and automated equipment in the fabrication and assembly stages of the hull construction process. But in order to use such equipment efficiently, the variety of frame spaces must be narrowed to a number of compatible

A P "

FP

Transverse Frame Space L=Lbp					
Space (mm) L(m)	Spa	Se	Sm		Spf
			Tanker & Ore C.	Bulk C. Cargo	
90 ≤ L < 100	600	700	3,800	not	2,000- 2,400
100 ≤ L < 120	700	750		stand-	
120 ≤ L < 150				ardized	
150 ≤ L < 200	800	800	4,600	800	2,440- 3,000
200 ≤ L < 250			4,800		
250 ≤ L < 290			5,000		
290 ≤ L < 320	900	900	5,300		
320 ≤ L			5,100 (Hor.Main)		
					3,000- 3,300

Longitudinal Space B=Breadth mld.		
Space (mm) B (m)	Longl. Space	
	Deck & Bottom	Side
B < 16	not Standardized	
16 ≤ B < 23	750	750
23 ≤ B < 32.2	800	800
32.2 ≤ B < 54.5	850	850
54.5 ≤ B	940	850

Figure 3. Standard frame space modules.

modules.

Of course, in selecting the frame space modules, the influence on hull Steel weight has to be carefully analyzed to restrain the weight increase to minimum. Also, the influence on outfitting, such as layout of cabins, pipe and cable ducts, etc., should be checked to assure that adequate space or accessibility is available by using the standard frame spaces.

Standard frame space modules permit the efficient use of rationalized and automated production facilities which, in turn, provide higher accuracy and quality in fabrication and assembly work. Figures 4, 5, and 6 show some of the machines used for fabricating and *assembling* steel structures in one of IHI's shipyards. These machines are all designed to match the frame space modules and, as a result, have played a great role in reducing manhours, not only by replacing man-power, but also by diminishing adjustment work due to their high accuracy in fabrication and assembly work.

Base Ship Modules. The "base ship module" concept is an extension of the "frame space module" applying to the selection of hull dimensions. This concept is useful in establishing "standard ship" designs, such as for tankers and dry bulk carriers. It is essential to conduct research in the worldwide shipping market to seek the demands of ship types, sizes, cargo flows, physical limitations in harbors, etc., to establish the characteristics of the "base ship . "

The "base ship" can be utilized as a basic hull form for a series of ship designs, and by selecting several sizes of "base ships" it would be possible to cover the major part of the market demand. Each "base ship" should be optimized in hull form and dimensional ratios but allowing some resiliency in length, depth and draft within predetermined limits to maintain the ship's functional properties. Figure 7 exemplifies how to modify the dimensions of a "base ship."

To decide hull dimensions for a specific requirement, a "base ship" having the nearest dimensions and functional properties is selected. To modify the hull dimensions, the fore part and the aft part (including engine room) of the "base ship" remain unchanged, and the necessary modifications will be made on the ship's parallel body.

In order to obtain the required cargo capacity, draft, or deadweight, the

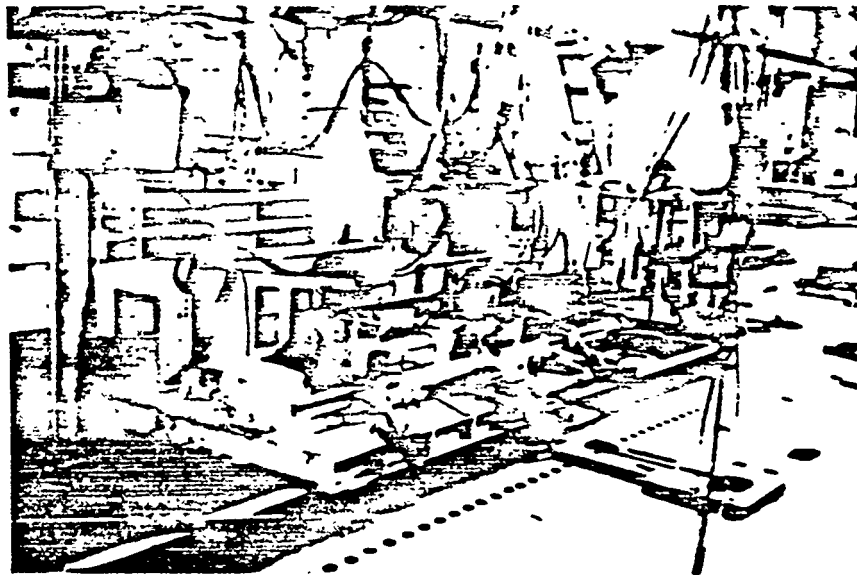


Figure 4. Multi slot machine.

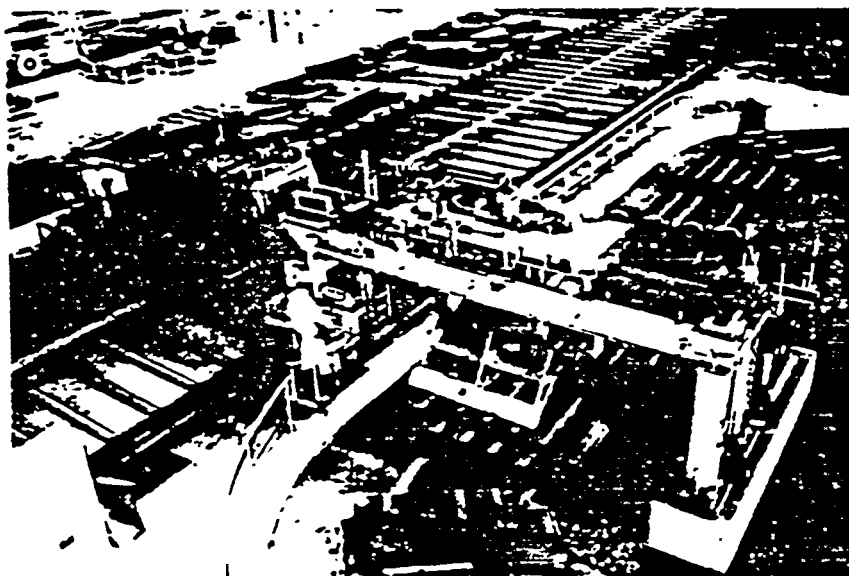


Figure 5. Submember assembly machine.

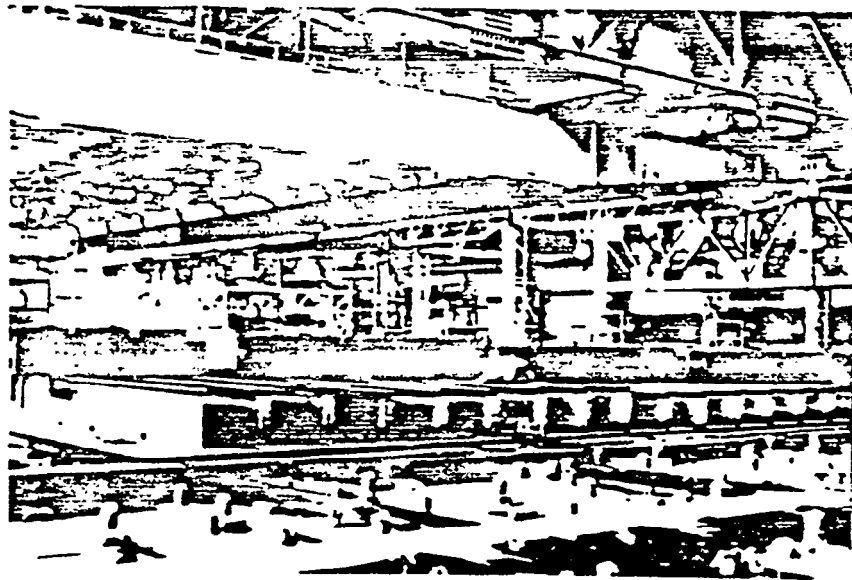


Figure 6. Longitudinal frame assembly machine.

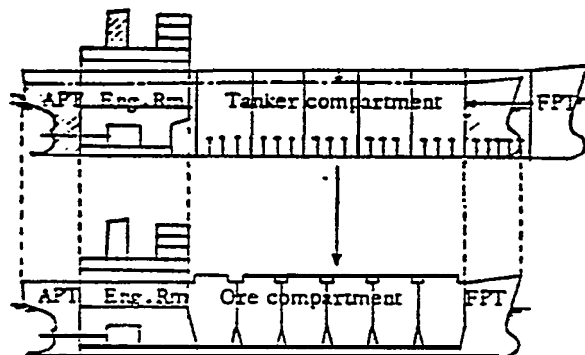


Figure 7. Example of base ship modification.

ship's length will be adjusted by adding or deducting multiples of transverse frame space modules, and similarly, the ship's depth will be adjusted by multiples of longitudinal frame space modules in the case of longitudinally framed ships.

The limitations of extension or reduction of the ship's length or depth will be predetermined by checking the influence on the hull weight and speed to avoid extraordinary deviations. Figure 8 shows a chart of the typical base ship variation limits.

The cargo compartment will also be left interchangeable so that any type of cargo section, such as for a tanker, ore carrier, or bulk carrier, can be inserted. Figure 7 shows the base-ship tanker modified to an ore carrier.

The midship section of the cargo compartment will be modularized to match with the frame space module and the standard ship's breadth, which is usually limited by the breadth of the building berth or the building dock. In other words, for a fixed ship's breadth, the hatch breadth of a bulk carrier or an ore carrier, or the disposition of longitudinal bulkheads of a tanker or an ore carrier, will remain unchanged irrespective of the adjustment in the ship's length or depth.

By adopting these base ship" modules, the designer can easily select the required dimensions and cargo sections based on pre-studied data, so there is no necessity to start from scratch. This permits great savings in design work without impairing the ship's functions.

At IHI, the advantage of "base ship" modules was enhanced by adopting the "working unit" in hull erection *work*. Figure 9 shows a "working unit" designed for work in the wing tanks of a standard VLCC. The "working unit" is a mobile construction machine designed to incorporate hydraulic clamping devices, automatic welding equipment, movable stages (or scaffolding), and other necessary appliances required for hull erection. The unit is designed to fit within the structural configuration of the "base ship", and travels on portable rails laid on the floor of the hull structure. The unit moves lengthwise in accordance with a predetermined construction schedule so all work must be completed and inspected before the unit moves to the next position. Careful planning of production sequences and time scheduling is

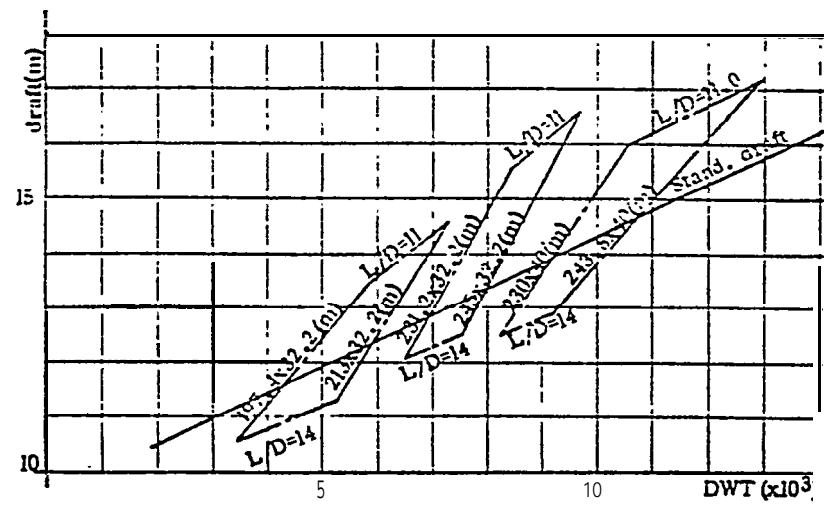


Figure 8. Example of base ship variations.

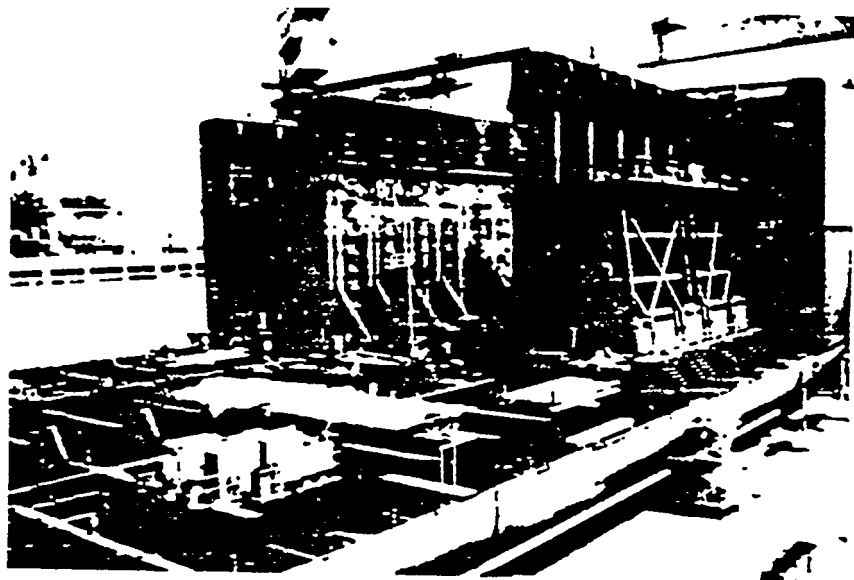


Figure 9. *working unit.*

required for smooth and punctual operation.

By using these "working units", the following advantages were obtained:

(1) All portable scaffolding in the cargo compartment could be omitted. In the case of a VLCC, about 15,000 stage planks had been required.

(2) Working and production procedures, such as sub-dividing work zones, and sequencing of fitting-welding-painting-inspection work flow, became established. Also, production scheduling, material handling, work force deployment, testing and inspection scheduling, etc., could be precisely controlled.

(3) All work can be executed on safe-guarded platforms, so this safe working environment led to improvements in productivity and quality.

#### B. Machinery Modules

When the engine power required for the propulsion plant has been decided, the machinery designer starts planning its associated machinery, piping systems, and their layout. The following are some examples of the modules utilized in machinery design.

Propulsion Engine Particular Modules. The systems and ancillary machinery pertinent to the type of main engine are virtually invariable. Therefore, the particulars of pumps, heat exchangers, etc., can be pre-determined and standardized without interfering with other systems. Some options could be left to meet specific requirements of the clients, such as number of standby pumps, purifiers, and so on.

Figures 10 to 13 show examples of the particular module for propulsion steam turbines with some of its pertinent ancillary machinery. Similar modules can also be established for diesel propulsion plants, classified by engine types and ratings. All modules are stored in the computer data bank, so when the main engine is selected, the designer can automatically obtain all ancillary machinery particulars by simply inputting the key data into the program.

Machinery Layout Modules. The physical arrangement of machinery and equipment in the engine room will be laid out as soon as their particulars are decided. Most of the machinery is grouped into systems, such as cooling



Main Steam Turbine					Mach. No.	MOD	
Main Eng. rating	P S	24,000	27,000	30,000	33,000	36,000	40,000
M. Turbine	Type	Impulse, 2-Cyl, cross compound turbine with 2-st. red. gear					
	H. P. Turbine	CNH-21		CNH-22	CNH-31	CNH-32	
	L. P. Turbine	CNL-21		CNL-41	CNL-51		
	Weight	t	46.61	49.83	52.03	55.25	
Red. Gear	Type	Tandem	Dual tandem				
	Prop. Shaft RPM	80					
	Type	C 4 5 A	D 4 9 A			D 5 1 A	
	Weight	t	145.0	148.0		166.0	
Stand. Drawg. No.		S D 1	41112110	41112120	41112130	41112140	41112150

Figure 10. Typical machinery particular module.

Main Condenser Pump					Mach.No.	MO 21			
					Type	V E C			
Main Eng. Rating		P S	24,000	27,000	30,000	33,000	36,000	40,000	
Motor A	Capacity	m <sup>3</sup> /h x m	70 x 95	75 x 95	85 x 100	90 x 100	100 x 100	110 x 105	
	Model No	E V Z 130							
	Stand. Drawg. No	S D 1	440011380A						
	Motor capacity	KW x rpm	37 x 1800	45 x 1800	55 x 1800	75 x 1800			
	Motor Model No.		225S	225M	250M	280S			
	Capacity range	m <sup>3</sup> /h x m	70 x 95	71 x 95 90 x 95	86 x 100 85 x 100	86 x 100	100 x 100	103 x 105 130 x 105	
	Weight	Pump	t	0.59					0.64
		Motor	t	0.25	0.28	0.345	0.46		
Motor B	Model No.	250x125-2VCDS-A							
	Stand. Drawg. No.	SD 1	440021740A						
	Motor capacity		37 x 1800	45 x 1800	55 x 1800				
	Motor Model No.		225S	225M	250M				
	Capacity range	m <sup>3</sup> /h x m	70 x 95	71 x 95	85 x 100	86 x 100	100 x 100	110 x 105	
	Weight	Pump	t	0.61					
		Motor	t	0.25	0.28	0.345	0.46		

Figure 11. Typical machinery particular module.

Drain Pump (Large Size)					Mach. No.		M O 23	
					Type	V E C		
Cargo Pump Cap.		m <sup>3</sup> /h x m	3,500x125	4,000x125	3,500x150 4,000x150	4000x150	4500x150	5000x150
Cargo Pump Sets			3		3	4	4	4
Capacity		m <sup>3</sup> /h x m	70 x 90	80 x 90	90 x 95	110 x 95	130 x 95	70 x 100
Maker A	Model No.		EVZ 100		EVZ 130		EVZ130-2	EVZ-130
	Stand. Drwg. No.	SDx	440011360A		440011350		440011390	440011380
	Motor Capacity	KW x rpm	37 x 1800		45 x 1,600	55 x 1,600	75 x 1,800	45 x 1600
	Motor Model No.							
	Capacity range	m <sup>3</sup> /h x m	56~ 70 x 90	76~ 100 x 90	78~ 95 x 95	96~ 110 x 95	116~ 130 x 95	66~ 85 x 100
Weight	Pump	t						
	Motor	t						
Maker B	Model No.		200 x 100 - 2VCSE-A		250 x 125 - 2VCDS - A		300 x 150 - 2VCDS-A	250 x 125 - 2VCDS-A
	Stand. Drwg. No.	SD1	440021730A		440021740A		440021390	440021740
	Motor Capacity	KW x rpm	37 x 1,800		45 x 1,600	55 x 1,600	75 x 1800	45 x 1800
	Motor Model No.							
	Capacity range	m <sup>3</sup> /h x m	51~ 70 x 90	80~ 100 x 90	95 x 95	91~ 110 x 95	130~ 140 x 95	70~ 85 x 100
Weight	Pump	t						
	Motor	t						

Figure 12. Typical machinery particular module.

Drain Pump (Mid-Size)					Mach.No.		M O 23		
					Type		V E C		
Cargo Pump Cap.		m <sup>3</sup> /h x m	3500x125	4000x125	3500x150 4000x150	4000x150	4500x150 5000x150	5000x150	
Cargo Pump Sets			3		3		4	4	
Capacity		m <sup>3</sup> /h x m	40 x 90	50 x 90	50 x 95	60 x 95	70 x 95	70 x 100	
Maker A	Model No.	E V Z 100						EVZ130	
	Stand. Drwg. No.	SD1	440011360A						440011380
	Motor Capacity	KWxrpm	30 x 1,800			37 x 1,800		45 x 1,800	
	Motor Model No.								225 M
	Capacity range	m <sup>3</sup> /h x m	40~55 x 90	50 x 95	51~70 x 95		66 85 x 100		
	Weight	Pump	t						
	Motor	t							
Maker B	Model No.	200 x 100 - 2VCSE-A						250x125- 2VCDS-A	
	Stand. Drwg. No.	SD1	440021730						440021740
	Motor Capacity	KWxrpm	30 x 1,800			37 x 1,800		45 x 1800	
	Motor Model No.								
	Capacity range	m <sup>3</sup> /h x m	40~50 x 90	50 x 95	51~70 x 95		70~ 85 x 100		
	Weight	Pump	t						
	Motor	t							

Figure 13. Typical machinery particular module.

systems, fuel oil systems, L.O. Systems, purifier systems, etc. , to facilitate pre-outfitting in "units."

These individual machinery units are standardized as basic modules. The machinery arrangement of the engine room is designed by arranging these individual modules considering the piping layout, accessibility for maintenance and repairs, and margins for optional requirements. Figure 14 shows part of the machinery layout module of a standard steam driven VLCC.

Modification of an engine room arrangement can be done simply by modifying or replacing the basic modules. Figure 15 exemplifies a modification by adding one drain pump without interfering with the arrangement of other machinery .

Piping Layout Modules. Piping layout modules are developed either as a complete system or a partial unit in connection with the machinery layout modules. Figure 16 is the piping layout module corresponding to the machinery layout module shown in Figure 14. Figure 17 is a partial piping layout module of the drain tank and pumping system which was shown in Figure 15 (B), consisting of one atmospheric drain tank, three drain pumps, piping and instrumentation, assembled in one unit.

## 5-2. DETAIL DESIGN

The major work at the detail design stage is to convert the system-oriented drawings developed at the basic design stage to zone-oriented drawings. Systems are sub-divided into zones by composite drawings, and work packages (or pallets) are grouped for each zone. Detailed manufacturing drawings of larger machinery and/or outfitting modules are developed at this stage for on-block outfitting by combining or modifying basic modules.

Figure 18 shows the actual unit module of Figure 17. These units are accompanied with corresponding material lists which include the required material data for the module. Material and components of each unit are supplied to the workshop in pallets and assembled there into a complete package.

### "Patterns" and "Panels"

"Patterns" and "panels" are the terms used at IHI for basic modules of

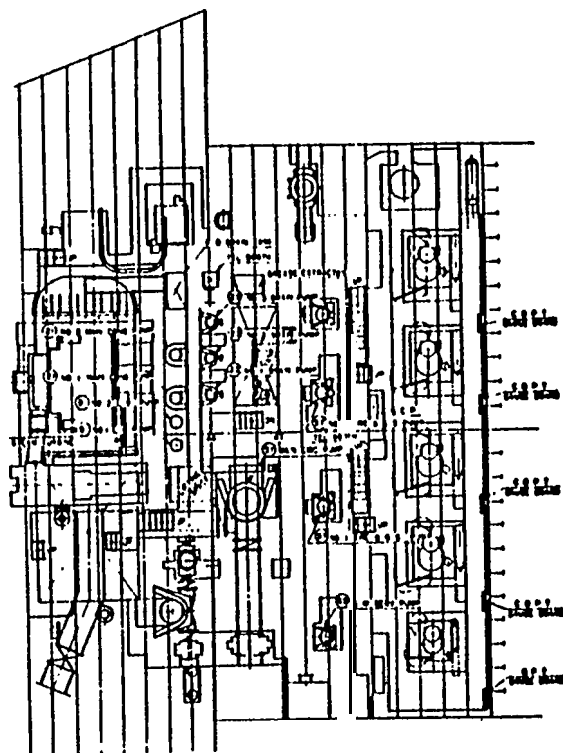


Figure 14. Machinery arrangement module.

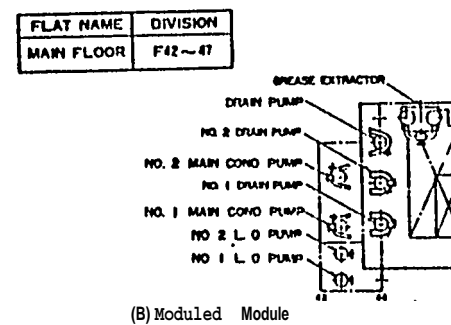
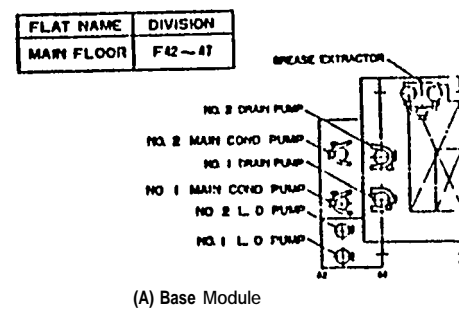


Figure 15. Modification of module.  
One additional drain pump is added in the modified module.

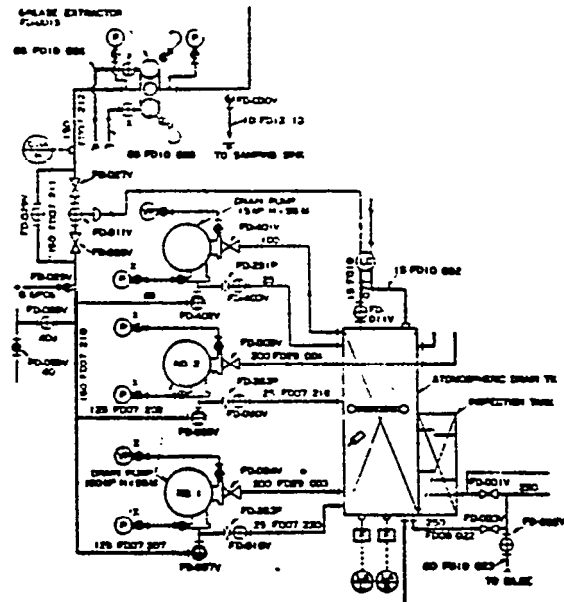


Figure 17. Pipe layout module.

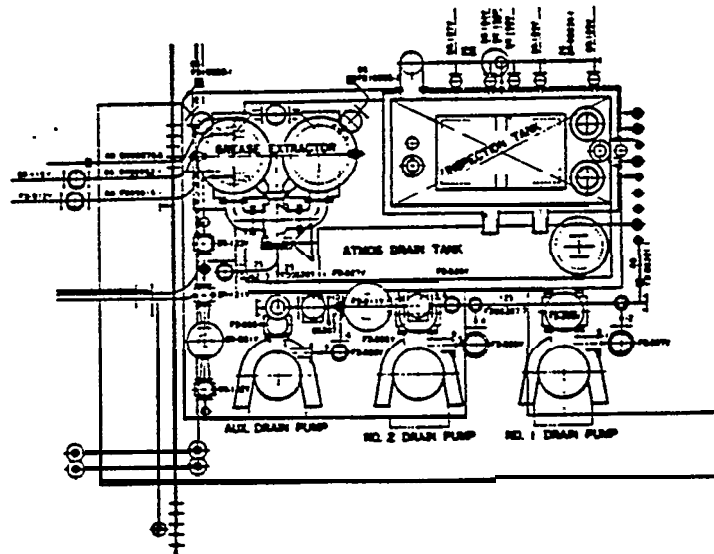


Figure 18. Example of unit equipment.

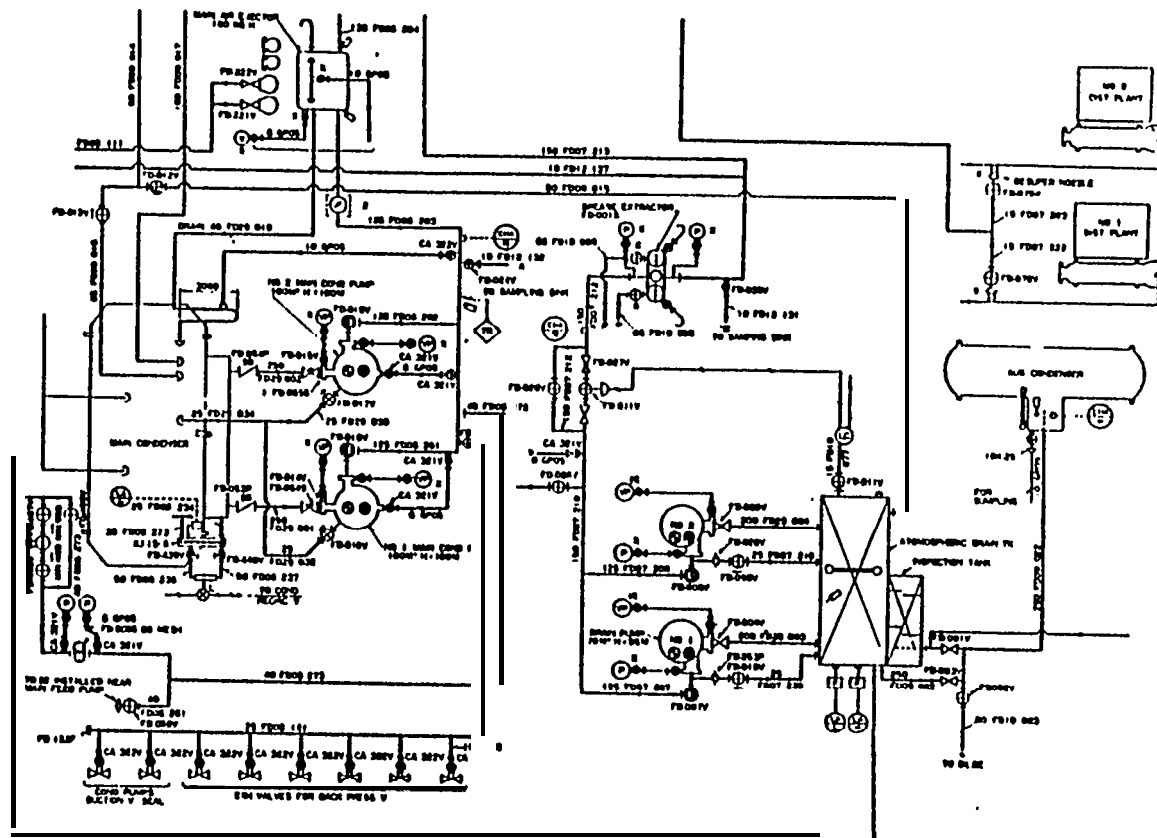


Figure 16. Piping layout module corresponding to the machinery layout module of Figure 14.

various systems. A "pattern" is a conceptual module, such as a partial piping diagram of a system that could be applied to different sizes and types of ships. For example, Figure 19 shows a "pattern" of the compressed air system diagrammatic on the main deck that matches the material ordering zone. The "pattern" is further divided into "panels" which are individual elementary modules of specific configurations, such as A, B and C, and are composed of a group of standard components. Virtually, the "panel" is an "invariable" module, but allowing selection in sizes and pipe detailing and painting to conform with the specifications, and the "pattern" is a "variable" module which could be modified by different combinations of "panels".

The "panel" includes an arrangement plan, a list of material size range, quantities of standard fittings, complete descriptions of pipes and fittings, standard guidance for pipe details and painting, etc., and is filed as the shipyard's standard. For a specific design, the designer retrieves this information from the file, selects the sizes of standard fittings and pipes and, if necessary, modifies the standard guidance to meet specifications requirements, adds non-standard materials and, finally, incorporates them in the material list.

Figure 20 shows patterns and panels of various systems integrated into a composite plan of a specific work zone (pallet). At this stage, exact dimensions, spacing, etc., are defined and entered into the drawings, and a material list of the pallet is created.

By using these patterns and panels, the detail design can be highly rationalized and simplified. Various combinations of patterns and panels of different systems can create machinery and piping layout modules as previously described for utilization in basic design.

### 5-3. MATERIAL PURCHASING

Material purchasing is a function that plays an important role in acquiring the required material for the ship's construction and feeding it to the production line at the appropriate time. Purchase orders and pertinent specifications must be prepared and distributed to the subcontractor with proper

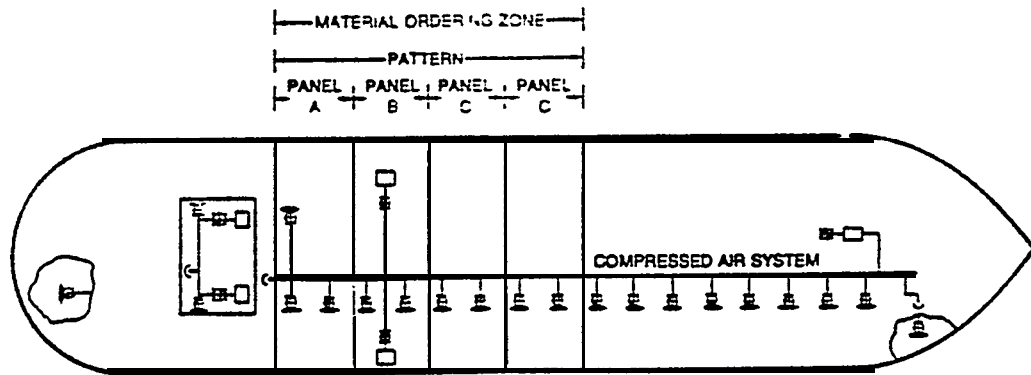


Figure 19. Patterns and panels.

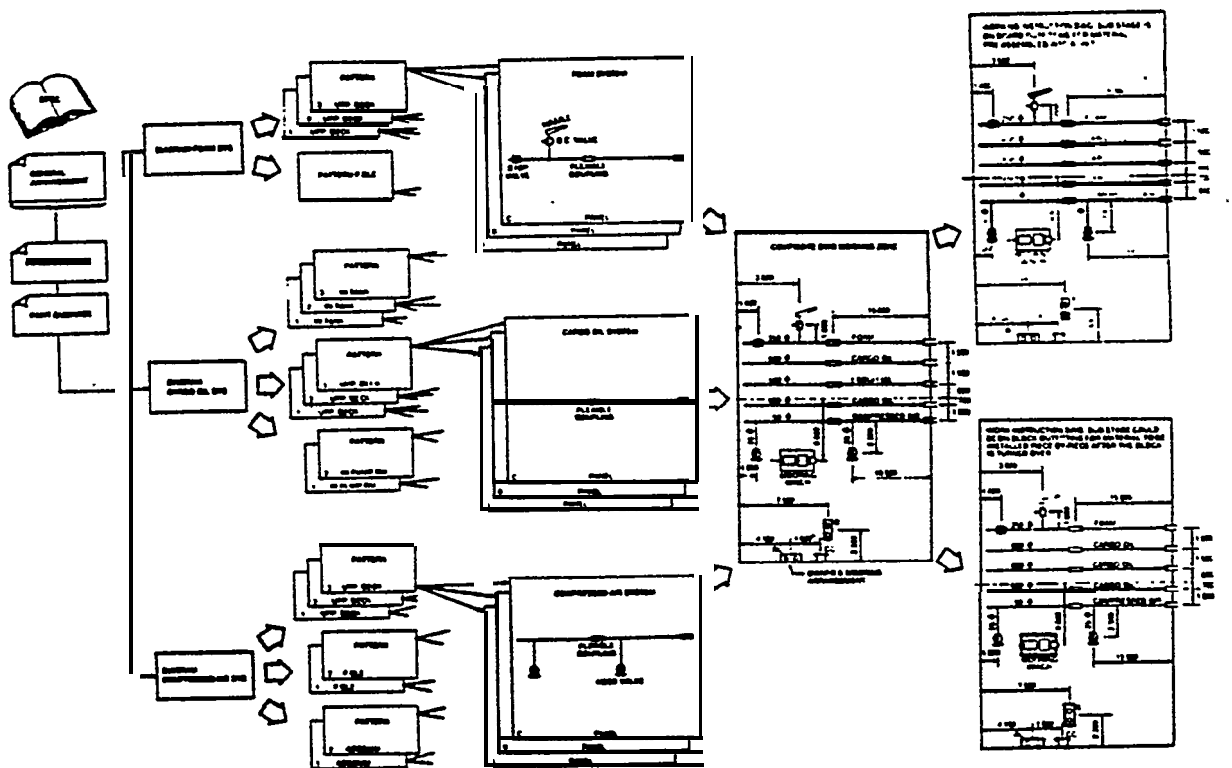


Figure 20. Application of patterns and panels.



consideration of the production schedule and the lead time required for manufacturing and delivery of the material. Also, efforts must be made to minimize stock so that the stockyards or warehouses are not overstocked with redundant material.

Material purchasing is considered as part of the "planning" process, whereas purchase specifications and manufacturing drawings must be issued by the design department. The issuance of these documents must be precisely scheduled and controlled to meet with the pallet schedules.

Usually, such work as preparation of purchase specifications, evaluation of vendors' proposals, etc., needs a long time before the orders are placed and also requires a great deal of paper work to finalize the contract with the vendors. The time and effort for these works can be considerably reduced if these materials are pre-approved and filed as part of the shipyard's standards.

For example, the Propulsion Engine Particular Module identifies the ancillary machinery required for the propulsion machinery. In this case, the machinery and equipment required for these modules could be pre-selected from several standard catalogue models of competent vendors. These models can be evaluated beforehand by extensive shop tests under shipyard supervision, and those eligible could be registered and filed as supplementary shipyard "standards." Specifications, drawings, test protocols, etc., could all be pre-approved by the shipyard. So, purchase orders can be extremely simplified by issuing a standard purchase order format and simply stating the required model number, quantity and delivery date to the vendor.

#### 5-4. PRODUCTION

As discussed previously, standardization and modularization will enhance productivity by allowing automated fabrication or assembly machinery to be introduced into the production line. Production scheduling and control can be conducted more precisely and accurately by using statistical records of standard work packages as yardsticks. Standard procedures and/or manuals for welding, pipe fabrication, tolerance, quality assurance, etc., can be used by both designers and workers and they could simplify instructions on individual working drawings.

#### 5-5. COMPUTERIZATION

The rapid progress of computer technology has led to wide application of computers for design and production in the shipbuilding industry. Many shipyards are now using computers for design calculations and analysis, No machines for gas cutting and pipe fabrication, etc. Consequently, shipyards have realized improved productivity and product quality. But the benefits of computerization cannot be fully enjoyed unless the individual computer processes from design to production are interfaced and integrated to form a "total system."

The total system interrelates design, material control, production, scheduling, and accounting systems. Without standardization, this massive system cannot be established rationally.

In order to file and process the massive data for an integrated system, a large computer and sophisticated software become essential. But shipyards which have little output capacity, or those who have to deal with a variety of one-of-a-kind ships, may not be able to afford to apply full computerization. But at least there are some systems or objects which can still be standardized or modularized to suit small computers, and may provide some benefit.

## VI. ADVANTAGES OF STANDARDIZATION AND MODULARIZATION

In conclusion, the concept of "standards" and "modules" is a viable technique to improve shipyard productivity without sacrificing the features of tailor-made designs. This is particularly important when it is realized that the combined use of computers and automated facilities is probably the best approach to modernizing the shipbuilding industry.

Standards and modules are now successfully applied to all ships built at IHI. The greatest achievement of standard ship designs were the F-series ships, nicknamed "Freedom," "Freedom Mark II," "Fortune," "Friendship," and "Future-32," that were developed in the late 1960's. These ships included various standard options for the client's selection, and were mass-produced in specially equipped shipyards to maximize production efficiency. For example, IHI's Tokyo shipyard produced a Freedom ship, (a multi-purpose cargo ship of about 14,000 DWT) in approximately 80 days, and by adopting pre-election and shifting methods, one building berth launched one ship in every 4 weeks.

A total of about 230 ships of the F-series have been built by IHI since 1967.

The standard tankers and bulk carriers also followed the same concept and the following advantages have been obtained:

(1) Reduction of Manhours. Figure 21 shows the design and production manhours of one of the standard F-series. Figure 21 (A) shows the design manhour curve compared with an unstandardized ship. It may be surprising that the design effort of the first ship required far more manhours than the unstandardized ship, but this reflects the elaborate initial planning required to implement the use of modules in connection with the production sequences, and to facilitate the exercising of various options without interfering with the base design. Figure 21 (B) shows the learning curve of the total Production manhours. The manhours dropped steeply to about 80% by the 5th ship and stabilized at about 55% by the 25th ship.

(2) Reduction in construction period. Compared with a similar unstandardized Ship the construction period could be reduced by almost one-half-

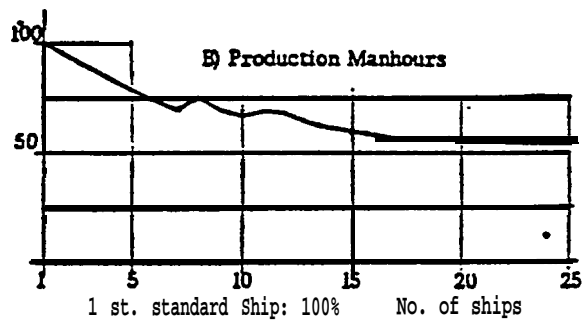
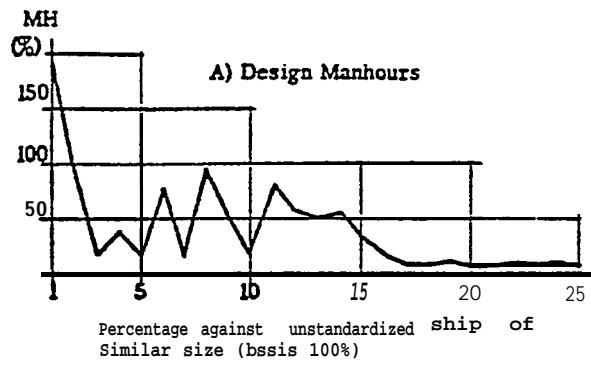


Figure 21. Learning curves of design and production manhours .

(3) Higher quality and reliability of products. Standards and modules are all based on long and proven experience in actual operation. Therefore, they assume high quality and reliability. also, by standardization, equal **function and quality could be maintained irrespective** of the designer's **skill.**

(4) Establishment of an integrated design-to-production computer system.

It is true that these advantages are most fully enjoyed in series-built standard designs or vessels of conventional types. Since the standards and modules are confined to systems or items that are most commonly used, there is difficulty in applying them in very special designs, such as systems required for liquified gas carriers, specialized chemical carriers, or other sophisticated ships, since these requirements will occur very seldom. But even then, systems having conventional features can still incorporate standardized and modularized equipment and, thus, contribute to reduction of design and production manhours.

APPENDIX B

F - SHIPBUILDING

## F - SHIPBUILDING

### General

Glossary of Terms for Shipbuilding (Machinery Part: General)  
Glossary of Terms for Shipbuilding (Machinery Part-Propulsion Machinery and Boilers)  
Glossary of Terms for Shipbuilding (Machinery Part-Auxiliary Machinery and Equipments)  
Glossary of Terms for Shipbuilding (Machinery Part-Instrumentation)  
Glossary of Terms for Shipbuilding (Machinery Part-Fittings)  
Glossary of Terms for Shipbuilding (Machinery Part: Testing, Working Practice, Miscellaneous)  
Glossary of Terms for Shipbuilding (Electric Part)  
Small Ships' Schemes of Heat or Sweat Insulation for Pipes  
Terminology and Definition of Output of Propulsion Machinery Installed in Ships  
Fittings of the Machinery of Ships to be Supplied by Manufacturers  
Terminology of Pressure used in Ships  
Sea Water Temperature for Designing Marine Heat Exchangers  
Coiled Springs for Marine Machinery  
Equipment and Adjusting Pressure of Escape Valves for Ship Machinery  
Application Standard for Use of Copper Pipes in Ships  
Test Code of Propelling Machinery at Sea Trials  
Shop Test Code for Marine AC Electric Overhead Travelling Cranes in Engine Room  
Standard of Machine Tools Facility in Ships  
Size of Spare Part Boxes for Marine Use  
Small Ships' Supply Standard for Hull Inventory Articles

### Hull Parts

Small Ships' Rudder Carriers  
Bollards  
Cast Iron Dog Type Chain Cable Compressors  
Cast Iron Deck End Rollers  
Steel Plate Deck End Rollers

## Hull Parts (Continued)

Closed Chocks

Open Chocks

Mooring Pipes

Spindle Type Hand Steering Gears

Ships' Hand Steering Wheels

Chain Type Hand Steering Gears

Leading Blocks for Chain Type Hand Steering Gear

Fair-leads

Cast Steel Dog Type Chain Stoppers

Cast Steel Tongue Type Chain Cable Stoppers for Grade 2 Chain Cable

Panama Chocks

Simple Type Bollards

Small Size Cast Iron Deck End Rollers

Small Size Steel Plate Deck End Rollers

Small Size Fairleads

Ships' Horizontal Rollers

Ships' Small Size Cast Steel Cable Compressors (Dog Type)

Ships' Small Size Stand Rollers

Cable Clenches

Fairleaders with Horizontal Rollers

Roller Tongue Type Chain Cable Stoppers for Grade 2 Chain Cable

Roller Dog Type Chain Cable Stoppers for Grade 2 Chain Cable

Double Type Cross Bitts for Tug Boats

Turnbuckles for Lumber Lashing

Chains for Lumber Lashing

Ships' Davits for General Use

Ships' Cranes for General Use

Ships' Cargo Hooks

Ships' Chains for General Use

Ships' Derrick Booms

Ships' Derrick Topping Brackets

Ships' Derrick Gooseneck Brackets



## Hull Parts (Continued)

Boom Rest Head Pieces  
Ships' Light Load Derrick Topping Brackets  
Ships' Light Load Derrick Gooseneck Brackets  
Ships' Light Load Derrick Booms  
Hatch Cleats  
Hatch Batten  
Hatch Wedge  
Ships' Manholes  
Ships' Non-watertight Steel Doors  
Ships' Butterfly Nuts  
Hatch Boards  
Watertight Sliding Doors  
Ships' Watertight Sliding Door Indicators  
Fittings for Ships' Weather-tight Steel Doors  
Ships' Ullage Holes  
Ships' Steel Weather-tight Doors  
Hatch Locking Bars  
Oiltight Hatch Covers  
Ships' Steel Small Hatch Covers  
Fittings of Ships' Steel Small Hatch Covers  
Ships' Ratchet Spanners  
Simple Type Hatch Cleats  
Marking of Hatch Boards  
Marking of Hatchway Beams  
Marine Small Size Manhole  
Fittings for Small Ships' Weather-tight Steel Door  
Covers for Tank Cleaning Holes  
Small Ships' Steel Weather-tight Doors  
Small Ships' Non-Watertight Steel Doors  
Ships' Cabin Hollow Doors  
Ships' Weather Hollow Doors  
Ships' FRP Doors for Provisions Refrigerating Chamber  
Ships' Bronze Side Scuttles

### Hull Parts (Continued)

Ships' Hinged Square Windows  
Ships' Light Construction Non-opening Scuttles  
Deck Lights  
Mushroom Ventilators  
Gooseneck Ventilators  
Cowlhead Ventilators  
Tempered Glasses for Ships' Side Scuttles  
Air Hatch Covers  
Ships' Aluminum Alloy Side Scuttles  
Ships' Sliding Windows  
Ships' Wall Ventilators  
Ships' Flame Arresters  
Ships' Wind Scooper for Slide Scuttle  
(Wind Scoopers) Anti-Mosquito Gauze of Side Scuttle for Marine Use  
Ships' Galley Windows  
Ships' Non-Opening Rectangular Windows  
Ships' Extruded Aluminum Alloy Rectangular Windows  
Ships' Footsteps  
Ships' Steel Vertical Ladders  
Steel Deck Ladders  
Small Size Steel Accommodation Ladders  
Ships' Wooden Handrail  
Ships' Handrail Stanchions  
Steel Wharf Ladders  
Aluminum Alloy Wharf Ladders  
Bulwark Ladders  
Pilot Ladders  
Panama Canal Pilot Platforms  
Embarkation Ladders  
Aluminum Alloy Accommodation Ladders  
Ships' Mouth Pieces for Voice Tube  
Mechanical Telegraphs

## Hull Parts (Continued)

Fittings for Steam Whistle

Lifeboats

Radial Type Boat Davit

Ships' Cross Bitts

Ships' Pulkah-Louvre

Ships' Rice Boilers

Ships' Steam Water Boilers

Ships' Oil Burning Cooking Ranges

Hinged Caps of Sounding Pipes

Deck Pieces for Sounding Pipes

Pipe Head Caps

Pipe Head Spanners

Ships' Bottom Plugs

Ships' Drain Plugs

Deck and Bulkhead Pieces for Transmission Shaft

Ships' 5 kgf/cm<sup>2</sup> and 10 kgf/cm<sup>2</sup> Deck and Bulkhead Pieces for Pipe Connection

Universal Joints of Transmission Shafts in Cargo Oil Tanks

Goose Neck Air Pipe Heads (Ball Float Type)

Scupper Fittings for Ships' Refrigerating Chambers

Gratings of Ships' Scupper Pipes

Ships' Cast Iron Pipe Sleeve Type Expansion Joints

Ships' Cast Steel Pipe Sleeve Type Expansion Joints

Self-closing Parallel Cook Heads for Short Sounding Pipe

self-closing **Gate** Valve Heads for Short Sounding pipe

Ships' Oil Suction Bellmouths

Ships' Steel Pipe Bands

Ships' U-Bolts for Steel Pipe

Bonnet Type Air Pipe Heads

Ships' Deck Stands for Controlling Valves

Remote Handling Fittings for Valves on Small Ships' Forepeak Bulkhead

Remote Handling Fittings for Valves in Small Ships' Cargo Oil Tank

## Hull Parts (Continued)

Ships' Deck and Bulkhead Pieces for Small Size Copper Tubes  
Ships' Foot Valves  
Bronze Vertical Storm Valves  
Cast Steel Vertical Storm Valves  
Bronze Screw-down Vertical Storm Valve  
Cast Steel Screw-down Vertical Storm Valves  
Ships' Hand Piston Pumps  
Hand Winches for Accommodation Ladders  
Anchors  
Cast Steel Anchor Chain Cables  
Electrically Welded Anchor Chain Cables  
Tools for Anchor Chain Cables  
Buoy Shackles  
Anchor Stoppers  
Anchor Buoys  
Anchor Stoppers (Small Size)  
Rigging Screw  
Chain Slings  
Chain Stoppers  
Small Size Chain Slings  
Ships' Eye Plates  
Ships' Ring Plates  
Sunken Link Plates  
Horn Cleats  
Ships' Wire Rope Stay Eye Plates  
Ships' Cargo Guy Cleats  
Ships' Small Size Snatch Blocks  
Ships' Sheaves  
Ships' Steel Guy Blocks with Swivels for Fibre Rope  
Lifeboats' Steel Blocks  
Ships' Steel Cargo Blocks  
Ships' Snatch Blocks  
Ships' External Bound Blocks

## Hull Parts (Continued)

Ships' Steel Blocks for Fibre Rope Guy  
Ships' Steel Blocks for Signal Flags  
Ships' Internal -Bound Blocks  
Ships' Steel Cargo Lifting Blocks for Topping Units  
Ships' Cast Steel Cargo Blocks with Roller Bearings  
Ships' Steel Plate Cargo Lifting Blocks with Roller Bearings  
Ship's Wire Reels  
Ships' Steel Wire Sockets  
Application Standard of Steel Wire Rope for Marine Use  
Application Standard of Hemp Rope for Ship Use  
Ship's Wire Nippers for Topping Lifts  
Ship's Small Size Wire Reels  
Application Standard of Steel Wire Rope for Small Ship  
Application Standard of Hemp Rope for Small Ship  
Fastening Method of Wire Ropes to Drum for Ship Use  
Application Standard of Ships' Canvas  
Ships' Hatch Beam Slings  
Ships' Small Size Wire Nippers for Topping Lift  
Ships' Small Size Steel Blocks  
Ships' Fire Axes  
Jacobs' Ladder  
Ships' Clinometers  
Ships' Bells  
Ships' Toggle Pins  
Ships' Chainlets  
Ships' Ring of Chainlet  
Ships' Eye Plates for Chainlet  
Dredger's Anchors  
Dredger's Sheaves for General Use  
Dredger's Discharge Pipes  
Dredger's Floaters

## Engine Parts

Shop Test Code for Marine Steam Turbines for Propelling Use  
Water Cooled Four Cycle Marine Diesel Engines for Propelling Use  
Marine **Hot-Bulb** Engines for Propelling Use  
Shop Test Code for Marine Internal Combustion Engines for Propelling Use  
Water Cooled Spark Ignition Marine Engines for Propelling Use  
Water Cooled Four Cycle Marine Diesel Engines for Electric Generator  
Fuel Injector of Marine Small Diesel Engine  
Fixing Parts of Ships' Small Propellers  
Morison Furnaces for Marine Use  
Size of Dry Combustion Cylindrical Boilers for Marine Use  
Fire Bar for Marine Use  
Forged Steel 20 kg/cm<sup>2</sup> Reflex Type Water Gauges with Cocks for Marine Boilers  
Forged Steel 20 kg/cm<sup>2</sup> Reflex Type Water Gauges with Valves for Marine Boilers  
Forged Steel 63 kg/cm<sup>2</sup> Transparent Type Water Gauges with Valves for Marine Boilers  
Shop Test Code for Marine Centrifugal Oil Purifiers  
Ships' Steam Cargo Winches  
Marine DC Electric Cargo Winches  
AC Electric Mooring Winches  
Steam Mooring Winches  
Hydraulic Mooring Winches  
Steam Anchor Windlasses  
DC Electric Anchor Windlasses  
AC Electric Anchor Windlasses  
Hydraulic Anchor Windlasses  
Shop Test Code for Hydraulic Steering Gears for Ships  
Shop Test Code for Oil Pressure Pumps of Hydraulic Steering Gears for Ships  
Ship's Small Size Fuel Oil Heaters  
Tachometers for Marine Engine  
Application Standard of Pressure Gauges on Board  
Standard for Thermometers Arrangement in Ship's Machinery Space  
Identification of Piping Systems for Marine Use

### Engine Parts (Continued)

Marine Turnbuckles with Eye Bolts  
Pressure Gauge Boards for Marine Auxiliary Machines  
Standard Velocity of Flow in pipes **of ship Machinery**  
Application Standard of Gaskets and Packings to Piping System for  
Marine Machinery  
Marine Ventilation Dampers  
Marine Can Water Filters  
Distance Pieces for Ship's Hull  
Marine Duplex Oil Strainers  
Marine Mud Boxes  
Marine Rose Boxes of Steel Plate  
Application for Wire Gauge of Oil Strainer for Marine Use  
Marine Duplex Oil Strainers (H Type)  
Marine Simplex Oil Strainers  
Marine Thermometer Pickets  
Marine 5 kgf/cm<sup>2</sup> Level Gauges with Valves  
Marine Oil Level Gauges with Self Closing Valves  
Marine 16 kg/cm<sup>2</sup> Water Gauges with Valve  
Marine Flat Glass Oil Level Gauges  
Marine Self Closing Valves for Oil Level Gauges  
Marine Float Level Gauges  
Marine Cylindrical Sight Glasses  
Marine Steel Plate Hoppers  
Marine Cast Iron 5 kg/cm<sup>2</sup> Y Type Steam Strainers  
Marine Cast Iron 10 kg/cm<sup>2</sup> Y Type Steam Strainers  
Marine Cast Steel 40 kg/cm<sup>2</sup> Y Type Steam Strainers  
Marine Small Size Water Strainers  
Marine Small Size Duplex Oil Strainers  
Marine Steel Plate Simplex Oil Strainers  
Double Bottom Tank Float Gauges for Coastal Ships  
Marine Tube Type Drain Silencers  
Marine Slit Type Drain Silencers  
Starting Air Reservoirs Made of Steel Plate for Marine Use  
Starting Air Reservoirs Made of Steel Tube for Marine Use

### Engine Parts (Continued)

Gauges for Small Size Fuel Oil Tank  
Application Standard for Marine Valves and Cocks  
Marine Bronze 5 kg/cm<sup>2</sup> Globe Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Angle **Valves**  
Marine Bronze 16 kg/cm<sup>2</sup> Globe Valves  
Marine Bronze 16 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Globe Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Iron 10 kg/cm<sup>2</sup> Globe Valves  
Marine Cast Iron 10 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Iron 16 kg/cm<sup>2</sup> Globe Valves  
Marine Cast Iron 16 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Steel 5 kg/cm<sup>2</sup> Globe Valves  
Marine Cast Steel 5 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Steel 20 kgf/cm<sup>2</sup> Globe Valves  
Marine Cast Steel 20 kgf/cm<sup>2</sup> Angle Valves  
Marine Cast Steel 30 kgf/cm<sup>2</sup> Globe Valves  
Marine Cast Steel 30 kgf/cm<sup>2</sup> Angle Valves  
Marine Cast Steel 40 kgf/cm<sup>2</sup> Globe Valves  
Marine Cast Steel 40 kgf/cm<sup>2</sup> Angle Valves  
Marine Cast Steel 10 kgf/cm<sup>2</sup> Globe Valves  
Marine Cast Steel 10 kgf/cm<sup>2</sup> Angle Valves  
Marine Malleable Iron 5 kgf/cm<sup>2</sup> Globe Valves  
Marine Malleable Iron 5 kgf/cm<sup>2</sup> Angle Valves  
Marine Malleable Iron 16 kgf/cm<sup>2</sup> Globe Valves  
Marine Malleable Iron 16 kgf/cm<sup>2</sup> Angle Valves  
Marine Forged Steel 40 kg/cm<sup>2</sup> Screwed Globe Valves (Union Bonnet Type)  
Marine Forged Steel 40 kg/cm<sup>2</sup> Screwed Angle Valves (Union Bonnet Type)  
Marine Forged Steel 40 kg/cm<sup>2</sup> Flanged Globe Valves (Union Bonnet Type)  
Marine Forged Steel 40 kg/cm<sup>2</sup> Flanged Angle Valves (Union Bonnet Type)  
Marine Cast Iron Hose Valves  
Marine Bronze Hose Valves  
Marine Hose Connections and Fittings  
Marine Forged Steel Screwed Globe Valves for Compressed Air



### Engine Parts (Continued)

Marine Forged Steel Screwed Angle Valves for Compressed Air  
Marine Forged Steel Flanged Globe Valves for Compressed Air  
Marine Forged Steel Flanged Angle Valves for Compressed Air  
Marine Cast Steel Globe Valves for Compressed Air  
Marine Forged Steel 100 kg/cm<sup>2</sup> Pressure Gauge Globe Valves  
Marine Bronze 20 kgf/cm<sup>2</sup> Pressure Gauge Cocks  
Marine Bronze 5 kg/cm<sup>2</sup> Globe Valves (Union Bonnet Type)  
Marine Bronze 5 kg/cm<sup>2</sup> Angle Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Globe Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Angle Valves (Union Bonnet Type)  
Marine Hull Cast Steel Angle Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Lift Check Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Lift Check Globe Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Lift Check Angle Valves  
Marine Hull Cast Steel Gate Valves  
Marine Cast Iron 5 kgf/cm<sup>2</sup> Gate Valves  
Marine Cast Iron 10 kgf/cm<sup>2</sup> Gate Valves  
Marine Hull Cast Steel Globe Valves  
Marine Cast Steel 10 kgf/cm<sup>2</sup> Gate Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Rising Stem Type Gate Valves  
Marine Bronze 10 kg/cm<sup>2</sup> Rising Stem Type Gate Valves  
Marine Bronze 5 kgf/cm<sup>2</sup> Swing Check Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Swing Check Valves  
Marine Cast Iron 10 kgf/cm<sup>2</sup> Swing Check Valves  
Marine Cast Iron 10 kg/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Cast Iron 10 kg/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Cast Iron 16 kg/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Cast Iron 16 kg/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Brass 30 kg/cm<sup>2</sup> Stop Valves with Bite Joint(s)

### Engine Parts (Continued)

Marine Bronze 5 kgf/cm<sup>2</sup> Flanged Cocks  
Marine Bronze 16 kgf/cm<sup>2</sup> Cocks  
Marine Bronze 20 kgf/cm<sup>2</sup> Globe Valves  
Marine Bronze 20 kgf/cm<sup>2</sup> Angle Valves  
Marine Cocks with Locks  
Marine Cast Iron 3 kg/cm<sup>2</sup> Globe Valves  
Marine Cast Iron 3 kg/cm<sup>2</sup> Angle Valves  
Marine Bronze 3 kg/cm<sup>2</sup> Globe Valves  
Marine Bronze 3 kg/cm<sup>2</sup> Angle Valves  
Marine Cast Iron 3 kg/cm<sup>2</sup> Gate Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Suction Manifold Valves  
Marine Cast Iron 5 kg/cm<sup>2</sup> Discharge Manifold Valves  
Marine Fuel Oil Tank Self-Closing Drain Valves  
Marine Fuel Oil Tank Emergency Shut-Off Valves  
General Rules for Inspection of Marine Valves and Cocks  
Marine Cast Steel 30 kg/cm<sup>2</sup> Flange Type Escape Valves  
Marine Forged Steel 30 kg/cm<sup>2</sup> Screw Escape Valves  
Marine Bronze 5 kg/cm<sup>2</sup> Screw-Down Check Globe Valves (Union Bonnet Type)  
Marine Bronze 5 kg/cm<sup>2</sup> Screw-Down Check Angle Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Screw-Down Check Globe Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Screw-Down Check Angle Valves (Union Bonnet Type)  
Marine Bronze 5 kg/cm<sup>2</sup> Lift Check Globe Valves (Union Bonnet Type)  
Marine Bronze 5 kg/cm<sup>2</sup> Lift Check Angle Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Lift Check Globe Valves (Union Bonnet Type)  
Marine Bronze 16 kg/cm<sup>2</sup> Lift Check Angle Valves (Union Bonnet Type)  
Marine Forged Steel 20 kg/cm<sup>2</sup> Screwed Globe Valves (Union Bonnet Type)  
Marine Forged Steel 20 kg/cm<sup>2</sup> Screwed Angle Valves (Union Bonnet Type)  
Brass 30 kg/cm<sup>2</sup> Unions with Bite Joint(s) for Marine Use  
Marine 10 kg/cm<sup>2</sup> Brazed Unions for Copper Tube  
Marine 10 kg/cm<sup>2</sup> Screwed Unions for Copper Tube  
Marine 10 kg/cm<sup>2</sup> Welded Unions for Steel Pipe  
Marine 10 kg/cm<sup>2</sup> Screwed Unions for Steel Pipe  
Marine 20 kg/cm<sup>2</sup> Brazed Unions for Copper Pipe  
Marine 20 kg/cm<sup>2</sup> Screwed Unions for Copper Pipe

### Engine Parts (Continued)

Marine 40 kg/cm<sup>2</sup> Welded Unions for Steel Pipe  
Marine 40 kg/cm<sup>2</sup> Screwed Unions for Steel Pipe  
Marine 100 kg/cm<sup>2</sup> welded Unions for Steel Pipe  
Marine 100 kg/cm<sup>2</sup> Screwed Unions for Steel Pipe  
Level Gears for Marine Use  
Marine Universal Joints  
Marine Transmission Shaft Joints  
Marine Transmission Shaft Loose Joints  
Bearings for Marine Transmission Shaft  
Remote Shut-Off Devices for Marine Fuel Oil Tank Emergency Shut-Off Valves  
Marine Cast Steel 10 kg/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Cast Steel 10 kg/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Cast Steel 20 kgf/cm<sup>2</sup> Screw-Down Check Globe Valves  
Marine Cast Steel 20 kgf/cm<sup>2</sup> Screw-Down Check Angle Valves  
Marine Cast Steel Angle Valves for Compressed Air  
Marine Steel Gratings  
Marine Steel Ladders and Steel Handrails  
Spare Parts for the Machinery of Ships  
Tools and Outfits for the Machinery of Ships  
Engine Stores for Coastal Ships  
Beam Grabs for Marine Use  
Special Tools for the Machinery of Ships  
Fat-to-Face Dimensions of Marine T Pieces with Flanges  
Marine Silver Brazing 5 kgf/cm<sup>2</sup> Pipe Flanges  
Basic Dimensions of Steel Flanges for Marine Exhaust Gas Pipe

### Electric Parts

Method of Watertight Testing for Marine Electric Appliances  
General Rules on the Temperature Test of Electric Lighting Fittings  
(Incandescent Lamps) for Marine Use

### Electric Parts (Continued)

Graphical Symbols for Electrical Apparatus (Power) for Marine Engineering Drawings

Graphical Symbols for Electrical Apparatus (Lighting Fittings and Accessories) for Marine Engineering Drawings

Graphical Symbols for Electrical Apparatus (Communication) for Marine Engineering Drawings

Lead-Acid Marine Batteries

Lamp Holders for Marine Use

Glass Globes for Marine Electric Lights

Front Glasses for Marine Electric Lights

Glass Globes for Marine Indicator Lamps

Lenses for Marine Morse Signal Lamps

Marine Lamps

Recessed Type Ceiling Lights for Marine Use (Non-watertight Type)

Ceiling Lights for Marine Use (Non-watertight Type)

Cargo Lights

Boat Deck Lights

Pendant and Bracket Lights for Marine Use

Watertight Type Hand Lamps for Marine Use

Watertight Type Wall Lights for Marine Use

Floodlighting Projectors for Marine Use

Berth Lights for Marine Use

Chart Table Lights

Flameproof Ceiling Lights for Marine Use

Flameproof Bulkhead Lights for Marine Use

Explosion-Proof Flash Lights for Marine Use (Dry Battery Type)

Hand Lamps for Marine Use (Non-watertight Type)

Portable Lamps (Simple Type) for Marine Use

Pendant Lights (Simple Type) for Marine Use

Cargo Lights (Simple Type)

Ballast for Fluorescent Lamp for Marine Use

Fluorescent Table Lamps for Marine Use

Fluorescent Wall Lights for Marine Use (Non-watertight Type)

Fluorescent Ceiling Lights for Marine Use (Non-watertight Type)

Fluorescent Ceiling Lights for Marine Use (Watertight Type)

### Electric Parts (Continued)

Fluorescent Berth Lights with Spare Light for Marine Use  
Watertight Type Passage Lights for Marine Use  
Special Type Cargo Lights  
Reflector Lamp Type Flood Lights for Marine Use  
Special Type Cargo Lights  
Reflector Lamp Type Flood Lights for Marine Use  
high Pressure Mercury Vapour Lamp Type Flood Lights for Marine Use  
Morse Signal Lamps for Marine Use  
Keys for Morse Signal Lamps for Marine Use  
Navigation Light Indicators  
Call Bell Indicators for Marine Use  
Daylight Signalling Lamps for Marine Use  
Portable Daylight Signalling Lamps for Marine Use  
Suez Canal Signalling Lamps  
Navigation Light Indicators (Simple Type)  
Search Lights for Marine Use  
Watertight Type Electric Bells for Marine Use  
Marine Electric Buzzers  
Push Buttons for Marine Use  
Electronic Horns for Marine Use  
Electric Propeller Shaft Tachometers for Marine Use  
Electric Rudder Angle Indicators  
Electric Telegraphs for Marine Use  
Small Size Electric Engine Telegraphs  
General Rules of Radio Telegraph for Ships  
Testing Methods of Radio Telegraph for Ships  
Marine Watertight Cable Glands (for Electric Appliances)  
Marine Cable Glands for Bulkhead and Deck  
Electric Cable Clips for Marine Use  
Electric Cable Hangers and Saddles for Marine Use  
Protective Rubber-like Sheaths of Portable Cord for Marine Use  
Small Size Terminals for Marine Use  
Electric Terminal Blocks for Marine Use  
Crimp Terminal Boards for Marine Use

## Electric Parts (Continued)

Watertight Type Joint Boxes for Marine Use  
Joint Boxes for Marine Use (Non-watertight Type)  
Distribution Boards (Fuse Type) for Marine Use  
Section Boards (Fuse Type) for Marine Use  
Shore Connection Boxes for Marine Use  
Simple Type Distribution Boards for Marine Use  
Simple Type Section Boards for Marine Use  
Distribution Boards with Circuit Breakers for Marine Use  
Section Boards with Circuit Breakers for Marine Use  
Shore Connection Boxes (Small Type) for Marine Use  
Non Watertight Type Plugs for Marine Use  
Watertight Type Plugs for Marine Use  
Watertight Type Receptacles for Marine Use  
Non-Watertight Type Receptacles for Marine Use  
Non-Watertight Type Snap Switches for Marine Use  
Watertight Type Small Switches for Marine Use  
Small Toggle Switches for Marine Use  
Unit Switches for Marine Use  
Rotary Switches for Marine Use  
Control Switches for Marine Flameproof Light  
Dimmers for Marine Lamps  
Dimmers for Marine Instrument Illumination  
Magnetic Compasses for Marine Use

## APPENDIX C

### MATERIAL STANDARDS

IS-S0 Common Part (A, B and C Type Code)  
IS-S0 Hull Part (Type-D Code)  
IS-S0 Machinery Part (Type-D Code)  
IS-S0 Electrical Part (Type-D Code)

### ENGINEERING STANDARDS

IS-S0T Application of Standard of Materials (in direct  
correspondence to IS-S0 Material Standards  
Numbering system)

IS-S0T - A Design Standard (General Facility and Work Plan)

IS-S0T - B Work Standard (Production Engineering Standards)

LIST OF IS-S0

COMMON PART

(A, B AND C - TYPE CODE)



IS-SO No.	NAME
001XXX	PIPE (STEEL)
002XXX	PIPE (NON-FERROUS)
0030XXX	VALVE (FC)
0031XXX	VALVE (FC/RUBBER LINING
0032XXX	VALVE (BC)
0033XXX	VALVE (SF)
0034XXX	VALVE (SC/BC TRIM)
0035XXX	VALVE (SC/SUS TRIM)
0040XXX	SHIP SIDE VALVE (SC)
0041XXX	SHIP SIDE VALVE (SC/RUBBER LINING)
0042XXX	SHIP SIDE VALVE (BC)
0045XXX	SPECIAL VALVE (JIS TYPE)
0048XXX	SAFETY VALVE (FOR C/O PIPE ETC.)
0051XXX	LEVEL CONTROL VALVE
0052XXX	FLOW CONTROL VALVE
0059XXX	OTHER VALVES AND COCKS
0060XXX	FLANGES (SS)
0061XXX	FLANGES (SF)
0063XXX	FLANGES (CR-MO)
0064XXX	FLANGES (FOR COPPER PIPE)
0065XXX	FLANGES (FOR COPPER ALLOY PIPE)
0066XXX	FLANGES (FOR PLASTIC PIPE)
0067XXX	FLANGES (FOR HYDRAULIC PIPE)
0069XXX	FLANGES (OTHERS)
0070XXX	PIPE PENETRATION PIECES
0071XXX	ELBOW, TEE, BACKING RING (BUTT TYPE)

IS-SO NO.	NAME
0072XXX	REDUCING TEE, REDUCER (BUTT TYPE)
0073XXX	SOCKET, ELBOW, TEE, ETC. FOR STEEL PIPE
0074XXX	ELBOW, TEE, SOCKET, ETC. (NON-FERROUS)
0075XXX	UNION JOINTS
0076XXX	ELBOW, TEE, REDUCER FOR POLIVINYL PIPE
0077XXX	FLANGE TYPE BEND PIECE, TEE, REDUCER
0078XXX	BOSS, PLUG, NIPPLE
0079XXX	OTHER PIPE PIECES
0080XXX	EXPANSION JOINTS
0081XXX	DRAIN TRAPS
0082XXX	STRAINERS AND FILTERS
0083XXX	MISC. PIPE FITTINGS (GROUP-1)
0084XXX	GASKETS
0085XXX	OTHER PACKINGS
0086XXX	MISC. PIPE FITTINGS (GROUP-2)
0087XXX	PIPE BANDS
0088XXX	U-BOLTS, PIPE SUPPORT FITTINGS
009XXX	BOLT, NUT AND WASHER
00051XX	HINGES, BUTTERFLY NUT
00052XX	EYE, RING PLATE, CLEATS
00053XX	WIRE SOCKET, CLIP
00054XX	SHACKLE, THIMBLE
00055XX	TURNBUCKLE, RIGGING SCREW
00056XX	MACHINE SCREW, SET SCREW
00057XX	WOOD SCREW, TAPPING SCREW, NAILS
00058XX	SPIRIT PIN, TAPER PIN, TOGGLE PIN



LIST OF IS-S0

HULL PART

(TYPE - D CODE)

IS-SO NO.	NAME
214XXXX	WOODEN CONSTRUCTION PARTS, OTHERS
221XXXX	FLOORING
224XXXX	MISC. MATERIAL
232XXXX	ANODE FOR CATHODIC PROTECTION
242XXXX	STEERING GEAR
243XXXX	NAVIGATION OUTFITS
244XXXX	INTERNAL COMMUNICATION
245XXXX	INSTRUMENT OF NAVIGATION
246XXXX	INSTRUMENT OF SIGNAL
252XXXX	ANCHOR, CHAIN CABLE
253XXXX	ANCHORING
254XXXX	MOORING OUTFITS
262XXXX	MAST, POST
263XXXX	BOOM
264XXXX	BLOCK
265XXXX	CARGO GEAR
266XXXX	SPECIAL CARGO GEAR
268XXXX	HATCH COVER
272XXXX	LIFE SAVING APPLIANCE
273XXXX	TRAFFIC OUTFITTING
274XXXX	HATCH COVER, MANHOLE AND DOOR
275XXXX	MISC. DAVIT
276XXXX	AWNING, HANDRAIL
277XXXX	MISC. FITTINGS
282XXXX	LIGHTING
283XXXX	VENTILATION AND AIR-CONDITIONING

IS-SO NO.	NAME
284XXXX	VENTILATION FOR CARGO HOLD AND C.O. TANK
285XXXX	VENTILATION FOR PUMP ROOM AND OTHER
293XXXX	MISC. FITTINGS FOR HULL PIPING
294XXXX	PUMPING
295XXXX	DRINKING, SANITARY, AND SCUPPER
296XXXX	STEM AND EXHAUST PIPING
297XXXX	HYDRAULIC PIPE
298XXXX	FIRE FIGHTING SYSTEM
313XXXX	CARGO OIL AND BALLAST HANDLING
314XXXX	DISTANCE PIECE FOR CARGO OIL HANDLING
315XXXX	FITTING FOR CARGO AND BALLAST PIPING
321XXXX	MATERIAL OF REMOTE CONTROL FOR C/O, BALLAST
322XXXX	FITTING OF REMOTE CONTROL FOR C/O, BALLAST
331XXXX	REF. PROV. CHAMBER, MATERIAL
332XXXX	PROV. CHAMBER
333XXXX	REF. CARGO HOLD, MATERIAL
334XXXX	JOINER WORK, MATERIAL
342XXXX	JOINER WORK, FITTING
3521XXX	BED, WARDROBE, CHEST, DESK
3522XXX	TABLE
3523XXX	CASE, RACK, LOCKER
3524XXX	CHART TABLE
3525XXX	SHELF
3526XXX	CHAIR
3527XXX	SOFA
3529XXX	OTHER

IS-SO NO.	NAME
353XXX	COMMISSARY OUTFIT
3541XXX	BATH, CLOSET, BASIN
3542XXX	MIRROR, LOCKER, TOILET CABINET
3544XXX	IRONING TABLE, RINSING TUB
3545XXX	CONSULTATION SEAT, STERILIZER TABLE
3546XXX	WATER CLOSET UNIT, BASIN PANEL
3549XXX	OTHER
3551XXX	MATTRESS, PILLOW, CURTAIN
3552XXX	TABLE CLOTH, CARPET
3553XXX	SPECIAL EQUIPMENT
35541XX	LOCK
35542XX	LATCH
35543XX	FITTINGS FOR DOOR
35544XX	HARDWARE FOR FURNITURE
35545XX	FURNISHING
35546XX	HARDWARE FOR SANITARY EQUIPMENT
35547XX	NAME PLATE, LABELING
35549XX	OTHER
3561XXX	WEATHER DOOR
3562XXX	JOINER DOOR
3563XXX	STAIR WAY
3564XXX	SHELVES FOR STORE
3569XXX	OTHERS
372XXX	MISCELLANEOUS
3731XXX	BOSUN'S AND CARPENTER STORE INVENTORY
3732XXX	FRAMES, BOX





LIST OF IS-S0  
MACHINERY PART  
(TYPE - D CODE)

IS-SO NO.	NAME
41XXXXX	MAIN ENGINE AND ACCESSORY
42XXXXX	BOILER
43XXXXX	SHAFTING AND PROPELLER
431XXXX	SHAFT, PROPELLER
432XXXX	BEARINGS
433XXXX	STERN BEARINGS
434XXXX	OTHERS (SHAFTING)
44XXXXX	AUXILIARY MACHINERIES
45XXXXX	FUNNEL, UPTAKE AND DRAFT TRUNK
451XXXX	FUNNEL, UPTAKE AND DRAFT TRUNK COMMON
452XXXX	FUNNEL
453XXXX	UPTAKE
454XXXX	M/E EXHAUST GAS PIPING
455XXXX	DRAFT TRUNK
46XXXXX	PIPE FITTINGS
462XXXX	MATERIALS FOR PIPING
463XXXX	PIPE FITTINGS, SUPPORT, ETC.
467XXXX	PIPE FITTINGS, STERILIZER, ETC.
468XXXX	PIPE FITTINGS, EQUIPMENT
469XXXX	PIPE FITTINGS, MISCELLANEOUS
47XXXXX	INSTRUMENTATION
471XXXX	GAUGES, GROUP-1
472XXXX	GAUGES, GROUP-2
473XXXX	CONTROL ROOM
48XXXXX	MISCELLANEOUS EQUIPMENT
481XXXX	TANKS



LIST OF IS-SQ  
ELECTRICAL PART  
(TYPE - D CODE)

IS-SO NO.	NAME
531XXX	INCANDESCENT LIGHT
532XXX	FLUORESCENT LIGHT
533XXX	PROJECTOR, CARGO LIGHT
536XXX	SIGNAL LIGHT
537XXX	EXPLOSION PROOF LIGHT
548XXX	MOTOR SIREN, BELL, PRESSURE SWITCH, ETC.
552XXX	POWER DISTRIBUTION AND ELECT. APPLIANCE
5721XXX	CABLE INSTALLATION MATERIAL
5722XXX	CABLE RACK
5723XXX	CABLE COAMING
5724XXX	CABLE GLAND
5726XXX	CABLE BAND
5727XXX	CABLE CONDUIT
5728XXX	MOUNTING BASE
5732XXX	NAME PLATE
5733XXX	APPLIANCE COVER
5736XXX	PROTECTION BOX FOR ELECTRIC APPLIANCE
5739XXX	OTHER ELECTRIC MATERIAL

LIST OF IS-SOT  
APPLICATION STANDARD  
OF  
MATERIALS

IS-SOT NO.	NAME
001XXXX	PIPE
003XXXX	VALVE
006XXXX	FLANGE
007XXXX	PIPE PIECES
008XXXX	PIPE FITTINGS
009XXXX	BOLT, NUT AND WASHER
0001XXX	STEEL FITTING
0005XXX	BASIC FITTING GEARS
0006XXX	TRANSMISSION GEARS FOR REMOTE HANDLING
00004XX	STEEL DOOR
00006XX	VENTILATOR
00007XX	MANHOLE COVER
24XXXXX	NAVIGATION, INTERNAL COMMUNICATION
25XXXXX	MOORING
26XXXXX	MAST, CARGO HANDLING, HATCH COVER
27XXXXX	OTHER OUT FITTING
28XXXXX	LIGHTING, VENTILATION
29XXXXX	PIPE FITTING
31XXXXX	CARGO OIL AND BALLAST PIPE
32XXXXX	CARGO OIL AND BALLAST PIPE, REMOTE CONT.
36XXXXX	DECK MACHINERY
37XXXXX	MISC. (HULL PARTS FITTING)
43XXXXX	SHAFTING AND PROPELLER
45XXXXX	FUNNEL, UPTAKE AND DRAFT TRUNK
46XXXXX	PIPE FITTINGS
47XXXXX	INSTRUMENTATION
48XXXXX	MISCELLANEOUS EQUIPMENT (ENGINE)

LIST OF IS-SOT-A  
DESIGN STANDARD  
GENERAL FACILITY AND WORK PLAN



IS-SOT NO.	NAME
A11XXXX	DESIGN GENERAL SYMBOL, CODE ETC.
A13XXXX	DESIGN GENERAL TEST PROCEDURE
A15XXXX	DESIGN GENERAL DRAWING PRACTICE
A16XXXX	DESIGN GENERAL BASIC ITEMS
A17XXXX	DESIGN GENERAL PROGRAM APPLICATION
A18XXXX	DESIGN GENERAL ENGINEERING ADMINIST.
A19XXXX	DESIGN GENERAL OTHERS
A21XXXX	BASIC DESIGN
A220XXX	HULL STRUCTURAL DESIGN (GENERAL)
A221XXX	HULL STRUCTURE MATERIAL APPLICATION
A222XXX	HULL STRUCTURE COMMON ITEMS
A223XXX	HULL STRUCTURE HOLD CONST.
A224XXX	HULL STRUCTURE E/R. P/R CONST.
A225XXX	HULL STRUCTURE BOW CONST.
A226XXX	HULL STRUCTURE STERN CONST.
A227XXX	HULL STRUCTURE SUPERSTRUCTURE
A228XXX	HULL STRUCTURE REDDER & STERN FRAME
A229XXX	HULL STRUCTURE OTHERS
A231XXX	HULL FITTING DESIGN, GENERAL
A232XXX	HULL FITTING DESIGN, OUTFIT.
A2320XX	HULL OUTFITTING GENERAL
A2321XX	HULL OUTFITTING STEERING & NAVIGATION SYSTEM
A2322XX	HULL OUTFITTING MOORING
A2323XX	HULL OUTFITTING CARGO HANDLING
A2324XX	HULL OUTFITTING HATCH COVER
A2325XX	HULL OUTFITTING TRAFFIC ARRANGEMENT & OPENING
A2326XX	HULL OUTFITTING LIFE SAVING
A2327XX	HULL OUTFIT. MISC. FITTING

IS-SOT No.	NAME
A2328XX	HULL OUTFITTING LIGHTING & VENTILATION
A2329XX	HULL OUTFITTING OTHERS
A2330XX	HULL FITTING DESIGN, PIPING GENERAL
A2331XX	HULL PIPING PUMPING
A2332XX	HULL PIPING FEEDWATER & SCUPPER PIPING
A2333XX	HULL PIPING STEAM & EXHAUST PIPING
A2334XX	HULL PIPING HYDROPIPE, REMOCON PIPE
A2335XX	HULL PIPING FIRE FIGHTING
A2336XX	HULL PIPING VENTILATION
A2337XX	HULL PIPING CARGO OIL PIPE, BALLAST PIPE
A2338XX	HULL PIPING VENT PIPE & INERT GAS SYSTEM
A2340XX	HULL FITTING JOINER WORK GENERAL
A2341XX	JOINER WORK ACCOMMODATION ARRANGMENT
A2342XX	JOINER WORK FURNITURE
A2343XX	JOINER WORK CABIN CONSTRUCTION
A2344XX	JOINER WORK LIGHTING
A2345XX	JOINER WORK EQUIPMENT & NAME PLATE
A2346XX	JOINER WORK NOISE & VIBRATION
A2347XX	JOINER WORK PROVISION STORE & REF.
A2348XX	JOINER WORK DOOR & STAIR WAT.
A2349XX	JOINER WORK WOODEN CONST.
A2356XX	DECK MACHINERIES REF. SYSTEM
A236XXX	INVENTORY OUTFITTING & SPARE PARTS
A2370XX	HULL FITTING CABIN CONSTRUCTION GENERAL
A2371XX	CABIN CONSTRUCTION CORRIDOR WALL
A2372XX	CABIN CONSTRUCTION WALL/CABIN TO CABIN
A2373XX	CABIN CONSTRUCTION CORRIDOR LINING WALL

IS-SOT No.	NAME
A2374XX	CABIN CONSTRUCTION CABIN LINING WALL
A2375XX	CABIN CONSTRUCTION CEILING LINING WALL
A2376XX	CABIN CONSTRUCTION FLOORING, INSULATION
A2377XX	CABIN CONSTRUCTION REF. PROVCHAMBER
A2378XX	CABIN CONSTRUCTION DOOR, STAIRWAY
A2379XX	CABIN CONSTRUCTION CARGO HOLD WOOD. WORK
A241XXX	MACHINE FITTING DESIGN GENERAL
A242XXX	MACHINE FITTING MAIN ENGINE
A243XXX	MACHINE FITTING BOILER
A244XXX	MACHINE FITTING SHAFT PROPELLER
A245XXX	MACHINE FITTING AUX. MACHINERIES
A246XXX	MACHINE FITTING FUNNEL, UPTAKE DRAFT TRUNK
A247XXX	MACHINE FITTING PIPING
A248XXX	MACHINE FITTING MISC. FITTING
A249XXX	MACHINE FITTING OTHERS
A251XXX	ELECT. FITTING DESIGN, COMMON ITEMS
A252XXX	ELECT. FITTING DESIGN, POWER SOURCE
A253XXX	ELECT. FITTING DESIGN, LIGHTING
A254XXX	ELECT. FITTING DESIGN, INTERIOR COMMUNI./NAV.
A255XXX	ELECT. FITTING DESIGN, RADIO
A256XXX	ELECT. FITTING DESIGN, AUTOMATIC/REMOCON SYSTEM
A257XXX	ELECT. FITTING DESIGN, FITTING WORK
A259XXX	ELECT. FITTING DESIGN, OTHERS
A261XXX	AUTO/REMOCON DESIGN
A280XXX	WELD. SURFACE TREATMENT, PAINT, (WELD)

IS-SOT No.	NAME
A281XXX	WELD. SURFACE TREATMENT, PAINT (S'TREAT)
A282XXX	WELD. SURFACE TREATMENT, PAINT (PAINT)
A283XXX	WELD. SURFACE TREATMENT PAINT (CATHODIC PRO.)
A29XXX	MISC. DESIGN
A311XXX	HULL PRODUC. ENG. DESIGN, GENERAL
A312XXX	HULL PRODUC. ENG. DESIGN, STRENGTH DESIGN
A313XXX	HULL PRODUC. ENG. DESIGN, DETAIL DESIGN
A314XXX	HULL PRODUC. ENG. DESIGN, PRODUCTION ENG.
A315XXX	HULL PRODUC. ENG. DESIGN, HULLPART PLAN
A316XXX	HULL PRODUC. ENG. DESIGN, STAGE PLAN
A321XXX	HULL FITTING PRODUC. DESIGN, COMMON ITEMS
A322XXX	HULL FITTING PRODUC. DESIGN, OUTFITTING
A323XXX	HULL FITTING PRODUC. DESIGN, PIPING
A324XXX	HULL FITTING PRODUC. DESIGN, WOODEN WORK
A325XXX	HULL FITTING PRODUC. DESIGN, VENT. AIR-CON
A326XXX	HULL FITTING PRODUC. DESIGN, DECK MACHINERIES
A327XXX	HULL FITTING DESIGN, WELD. OTHERS
A33XXX	MACHINERY PRODUCTION DESIGN
A347XXX	ELECT. FITTING PRODUC. DESIGN, FITTING WORK
A360XXX	PRODUC. DESIGN, GENERAL
A361XXX	PRODUC. DESIGN, PIPE FITTING PIECE



## APPENDIX D

### EXAMPLES OF IHI STANDARDS - SOT A221XXX

#### HULL STRUCTURE MATERIAL APPLICATION

NOTE: The standards contained in this section are included for instructional purposes only. Some are more recent versions of the ones listed on the following page, which is from the detailed index. No attempt, however, has been made to obtain the most recent revision of any standard.

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## HULL STRUCTURE MATERIAL APPLICATION

SOT-A221XXX

IS-NO	T I T L E	QTY	RMKS
A221001A	Rolled Steel for Hull Structure & It's Application	14	
A221002A	Application Of Steel Flat Bars For Fore & Aft Const.	2	
A221003A	Application of Slab Longitudinal for Fore & Aft Structure	2	
A221004B	Standard Rolled Steel Angles for Hull Structure	3	
A221005	Application of Built UP Sections for Fore & Aft Const.	9	
A221006A	Standard Types of Pillar for Fore & Aft Hull Construction	3	
A221007A	Application of Rolled Steel for Superstructure Const.	3	
A221008	Standard F. B Size Used for Cargo Parts	3	
A221011	Size of Steel Plate for Hull Const.	7	

IS

前後部構造 F B 標準寸法  
STANDARD SIZE OF FLAT BAR

SOT-A221002B

1<sup>2</sup>/<sub>4</sub>

FOR FORE AND AFT STRUCTURE

上段：断面係数 CM<sup>3</sup>中段：断面係数 CM<sup>2</sup>

下段：単位重量 KG/M

表 - 1

	50	65	75	90	100	125	150	180	200	230	250	300	350	400	450	500
6	7	10	13	← Section Modulus (CM <sup>3</sup> )												
	3.0	3.9	4.5	← Sectional Area (CM <sup>2</sup> )												
	235	306	353	← WEIGHT PER UNIT (KG/M)												
9			19	27	32	49	69	97								
			6.75	8.1	9.0	11.25	135	162								
			5.30	6.36	7.06	8.83	10.60	12.72								
10					36	54	76	107								
					100	125	150	180								
					7.85	9.81	11.78	14.13								
11					39	59	83	117	142							
					11.0	13.75	16.5	19.8	22.0							
					8.63	10.79	12.95	15.54	17.27							
12					43	64	90	127	154	200						
					120	150	180	216	240	276						
					9.42	11.77	14.13	16.96	18.84	21.67						
12.5					44	67	94	132	160	208	242					
					125	156.2	187.5	225	250	287.5	312.5					
					9.81	12.27	14.72	17.66	19.62	22.57	24.53					
14					74	104	146	178	230	269						
					175	210	252	280	322	350						
					13.74	16.49	19.78	21.98	25.28	27.18						
16					90	125	175	213	275	321	351	600				
					200	240	288	320	368	400	480	560				
					15.70	18.84	22.61	25.12	28.89	31.10	37.68	43.96				
19					117	205	249	322	376	526	699					
					285	342	380	437	475	579	665					
					22.37	26.85	29.83	34.30	37.29	44.71	52.20					
22					168	285	285	329	376	509	795	1016				
					330	440	440	550	660	770	880					
					25.90	34.51	34.51	43.17	51.81	60.41	69.08					
25					189	264	319	412	480	671	889	1131	1105	1702		
					375	450	500	575	625	750	875	1000	1125	1250		
					29.44	35.32	39.25	43.11	49.06	58.87	68.69	78.50	88.31	98.12		
23										531	740					
										700	840					
										54.95	65.91					
30											785		1324	1639	1984	
											900		1200	1350	1500	
											70.65		9420	10597	11775	
35														1864	2255	
														1575	1750	
														12361	13737	

注：断面係数 F・B の値が 1.4m 以上では 610×10、1.6m 以上では 610×15 の寸法が合致する。



IS

前後部構造用

SLAB LONG 適用基準

SOT-A221003A

1/2 I

APPLICATION OF SLAB LONGITUDINAL FOR  
FORE AND AFT STRUCTURE

1. 適用範囲 この基準は一般商船の前後部構造に使用する  
SLAB DECK LONG について規定する。

2. 標準寸法 下表の寸法を標準とする。  
STANDARD SIZE

SIZE 寸 法	SECTIONAL AREA A cm <sup>2</sup>	WITH PLATE = 610 × 15 I cm <sup>4</sup> Z cm <sup>3</sup> Z <sub>P</sub> cm <sup>3</sup>			WEIGHT 重量 kg/m
200 × 16	32.0	3,823	213	375	25.12
19	38.0	4,386	249	444	29.83
22	44.0	4,917	285	515	34.54
250 × 19	47.5	7,980	376	664	37.29
22	55.0	8,912	428	770	43.17
25	62.5	9,791	480	878	49.06
300 × 22	66.0	14,478	599	1,079	51.81
25	75.0	15,866	670	1,230	58.87
28	84.0	17,181	740	1,383	65.94
350 × 25	87.5	23,846	888	1,644	68.69
28	98.0	25,781	979	1,780	76.93
30	105.0	27,020	1,039	1,891	82.42
400 × 28	112.0	36,633	1,249	2,271	87.92
30	120.0	38,369	1,324	2,401	84.20
32	128.0	40,057	1,398	2,525	100.48
35	140.0	42,508	1,507	2,701	109.90
450 × 32	144.0	54,561	1,730	3,093	113.04
35	157.5	57,881	1,864	3,301	123.64
38	171.0	61,094	1,996	3,500	134.23
500 × 35	175.0	76,315	2,255	3,946	137.37
38	190.0	80,550	2,413	4,180	149.15
520 × 35	182.0	84,580	2,420	4,216	142.87
38	197.6	89,277	2,590	4,466	155.12
40	208.0	92,340	2,702	4,628	163.28
540 × 38	205.2	98,594	2,773	4,759	161.08
40	216.0	101,982	2,893	4,932	169.56

Z<sub>P</sub> = 塑性断面係数

\* MARKS SHOWN SPECIAL CASE

D-3 ※印は特に必要な時のみ使用する。



# STANDARD SIZE OF ROLLED SECTIONS FOR HULL STRUCTURE

SOT-A 221004C

#1

本基準は一般商船の船殻構造に使用する形鋼の標準寸法について規定する。

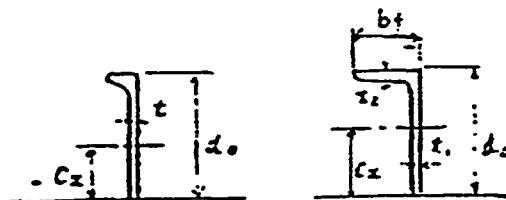
## 基準

- (1) 下表の右端“基準欄”に○印を付した形鋼を標準とする。
- (2) “基準欄”に△印を付した山形鋼はその断面 $E$ と $A$ 、 $W$ と損欠の比較検討を行い採否は船殻設部長決裁による。(解説5参照)
- (3) 等辺山形鋼の使用にその原則とする。

(4) 形鋼の寸法は下表に示す標準寸法を使用する。但し原則として縦断寸法には使用しない。(解説2参照)

NAME OF STILL MILL

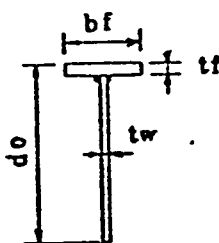
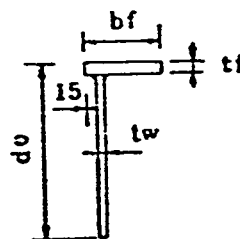
SIZE	$A_o (cm^2)$	$Z (cm^3)$	$I (cm^4)$	SELF I	$C_x$	$W$	新日本	標準
$d_o \times b_t \times t$		WITH $610 \times 15$	WITH $610 \times 15$	( $cm^4$ )	( $cm$ )	( $kg/m$ )		
EQUAL THICKNESS ANGLE	100 × 75 × 7	11.87	72.5	674	112	6.94	7.3	○ ○ ○
	125 × 75 × 7	13.62	97.2	1107	212	8.40	10.7	○ ○ ○
	125 × 75 × 10	19.00	130.0	1610	298	8.27	14.9	○ ○ ○
	150 × 90 × 9	20.94	101	2490	484	10.04	16.4	○ ○ ○
	150 × 90 × 12	27.36	230	3060	619	9.93	21.5	○ ○ ○
UNEQUAL THICKNESS ANGLE	200 × 90 × 9/14	29.66	340	5870	1210	13.64	23.3	○ ○ ○
	250 × 90 × 10/15	37.47	494	10300	2440	16.39	29.4	○ ○ ○
	250 × 90 × 12/16	42.95	540	11000	2790	16.01	33.7	○ ○ ○
	300 × 90 × 11/16	46.22	681	16400	4470	19.00	36.3	○ ○ ○
	300 × 90 × 13/17	52.67	743	17610	4940	18.70	41.3	○ ○ △
	350 × 100 × 12/17	57.74	956	25800	7440	22.00	45.3	○ ○ △
	400 × 100 × 12/18	64.77	1190	35200	10900	24.90	50.8	○ ○ △
	450 × 100 × 13/18	68.59	1230	36710	11500	24.60	53.8	○ ○ △
BULB PLATE	180 × 9.5	21.06	171	2860	673	10.51	16.5	○ ○ ○
	200 × 10	25.23	230	4150	1000	11.85	19.8	○ ○ ○
	250 × 11	31.97	330	6610	1680	12.7	25.1	○ ○ ○
	250 × 12	32.13	420	8920	2370	14.90	29.9	○ ○ ○



1. 適用範囲 本基準は一般船の前後部構造の DECK LONG $\frac{L}{2}$ , SIDE LONG $\frac{L}{2}$ , L.B $\frac{HD}{2}$  & T.B $\frac{HD}{2}$  STIFF., BOTTOM LONG $\frac{L}{2}$  等に使用する BUILT-UP SECTION について規定する。
2. 使用条件 "SOT-A221004B 船殻構造用標準形鋼" を OVER する SETCION THESE BUILT-UP SECTIONS WILL BE APPLIED IN CASE OF MODULUS を必要とする場合に使用する。  
UNCOVER THE ROLLED SECTIONS.
3. BUILT-UP SECTION の TYPE  
BUILT-UP SECTION の TYPE は T 型, L<sub>2</sub> 型の 2 種類とする。  
BUILT-UP SECTIONS ARE CLASSIFIED BOTH T AND L<sub>2</sub> TYPE.
4. 寸法表示法 BUILT-UP SECTION の寸法は次の様に表示する。

do × bf × tw/tf TYPE

T 型

L<sub>2</sub> 型

【例】 400×150×11/16 T

450×150×11/19 L<sub>2</sub>

5. 標準寸法 標準寸法表に示す寸法を BUILT-UP SECTION の標準とする。

WEB サイズ

(注) 650×14, 700×14 は BOTTOM LONG $\frac{L}{2}$  に使用する。

標準寸法表

WEIGHT

doxbrf×tw/tf	A cm <sup>2</sup>	I cm <sup>4</sup>	Z cm <sup>3</sup>	重量kg/m	備考
400×150×11/16	6624	39754	1355	52.0	WITH PL 610×15
19	7041	42844	1497	553	
22	7458	45714	1635	585	
450×150×11/16	7174	51787	1588	563	
19	7591	55600	1748	596	
22	8008	59203	1905	629	
25	8425	62565	2058	661	
500×150×11/16	7724	65590	1833	606	
19	8141	70301	2011	639	
22	8558	74709	2186	672	
25	8975	78836	2357	705	
550×150×11/16	8274	81398	2091	650	
19	8691	87027	2287	682	
22	9108	92310	2479	715	
25	9525	97272	2668	748	
28	9942	101934	2854	780	
30	10220	104885	2976	802	
32	10498	107717	3096	824	
600×150×11/19	9241	105860	2574	725	
22	9658	112087	2784	758	
25	10075	117950	2991	791	
28	10492	123474	3194	824	
30	10770	126979	3328	845	
32	11048	130349	3460	867	
35	11465	135163	3655	900	
650×150×11/22	10208	134117	3101	801	
25	10625	140948	3325	834	
28	11042	147398	3546	867	
30	11320	151500	3691	889	
32	11598	155449	3835	910	
35	12015	161103	4047	943	
38	12432	166449	4256	976	
650×180×11/28	11882	160419	4014	933	
30	12220	164990	4189	959	
32	12558	169369	4363	986	
35	13065	175602	4620	1026	
38	13572	181453	4872	1065	
650×200×11/30	12820	173369	4521	1006	
32	13198	177986	4715	1036	
35	13765	184530	5001	1081	
38	14332	190647	5282	1125	
650×230 11/32	14158	190024	5240	1111	
35	14815	196945	5570	1163	
38	15472	203375	5893	1215	次頁に続く

部 長

部 長

IS

前後部構造用PILLAR標準材  
STANDARD TYPES OF PILLAR FOR  
FORE&AFT HULL CONSTRUCTION

SOT-A 221006 B

1/28

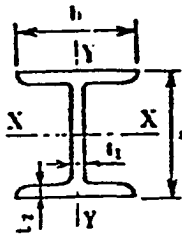
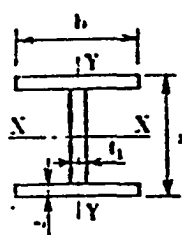
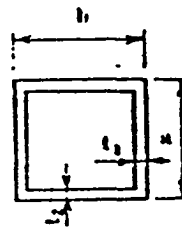
## 1. 適用範囲

この基準は一般船の船殻前後部構造に使用するPILLARの標準材について規定する。

## 2. 標準寸法

次表に示す寸法を標準とする。

## 2-1. H形、□形の断面形状

TYPE	CODE NUMBER 呼称	SIZE				SEC. AREA 断面積 A (cm <sup>2</sup> )	WEIGHT 重量 W (kg/m)	MOMENT OF INERTIA I <sub>x</sub> (cm <sup>4</sup> )	MOMENT OF INERTIA I <sub>y</sub> (cm <sup>4</sup> )	THE LEAST R OF GYRATION k (cm)
		a	b	t <sub>1</sub>	t <sub>2</sub>					
 (H - BAR)	H 15	150	150	7	10	40.14	31.5	1.640	563	3.75
	H 20	200	200	8	12	63.53	49.9	4.720	1.600	502
	H 25	250	250	9	14	92.18	72.4	10.800	3.560	629
	H 30	300	300	10	15	119.8	94.0	20.400	6.750	751
	H 35	350	350	12	19	173.9	137.	40.300	13.600	884
 (BUILT-UP)	H 40	400	400	13	21	218.7	172.	66.600	22.400	101
	H 50	500	500	14	25	313.0	246.	150.200	52.100	129
	H 60	600	600	16	28	423.0	332.	296.500	101.000	155
	H 70	700	700	19	30	541.5	425.	513.200	173.000	17.9
 (BUILT-UP)	H 80	800	800	22	35	720.6	566.	891.000	298.700	20.4
	S 35	350	350	14	14	188.2	148.	35.450	35.450	13.7
	S 40	400	400	14	14	216.2	170	53.750	53.750	15.8
	S 50	500	500	14	14	280.0	220	110.000	110.000	19.8
	S 60	600	600	16	16	370.0	290.	215.000	215.000	23.9
	S 70	700	700	16	16	437.7	344.	341.700	341.700	27.9
	S 80	800	800	16	16	501.8	394	514.000	514.000	32.0

IS	前後部構造用PILLAR標準材				SOT-A221006B		2 92
2-2 丸形の断面形状							
TYPE	呼 称	S I Z E		断面積 A(cm <sup>2</sup> )	重 量 W(kg・m)	MOMENT OF INERTIA I(cm <sup>4</sup> )	RADIUS OF GYRATION k(cm)
		OUT DIA mm	THICKNESS mm				
外 管	R100	114.3	8.6	28.6	22.4	401	37.5
	R125	139.8	9.5	38.9	30.5	829	46.2
	R150	165.2	11.	53.25	41.8	1587	54.7
	R200	216.3	12.7	81.29	63.8	4225	72.1
	R250	267.4	15.1	119.7	93.9	9557	89.4
	R300	318.0	17.4	164.3	129	18620	108
	R350	355.6	19.	200.9	158	28090	119
内 作	R419	400	19.	227.8	179	41370	135
	R422		22.	261.2	205	46830	134
	R519	500	19.	287.1	225	83200	170
	R522		22.	335.1	263	95540	169
	R619	600	19.	346.8	272	146500	206
	R622		22.	399.5	314	167000	204

部長
課長

## 1. 適用範囲

上部構造に使用する一般材料の種類およびその寸法について規定する。

## 2. 基 準

2-1 使用材料は各CLASSに適合したものであること。

2-2 型钢および平鋼寸法表

注 ※ 印の材料は一般には使用しない。

EQUAL  
FLANGE

	寸 法 (mm)	Wt (kg/m)	I (cm <sup>4</sup> )	Z (cm <sup>3</sup> )		寸 法 (mm)	Wt (kg/m)	I (cm <sup>4</sup> )	Z (cm <sup>3</sup> )
山形 不等辺 山形 THICKNESS ANGLE	75x 75x 6	6.9	91	31.9	平 FLAT BAR	65x 6	3.1		9.6
	100x 75x 7	9.3	674	72.5		75x 9	5.3		18.1
	125x 75x 7	9.7	1,110	97.2		90x 9	6.4		25.3
	150x 90x 9	16.4	2,490	181.0		100x 12	9.4		40.1
	200x 90x 9 1/4	23.5	5,870	340.0		100x 16	12.6		
	250x 90x 10 1/5	29.4	10,500	494.0		150x 12	14.1		
不等辺 不等厚 山形 THICKNESS ANGLE	300x 90x 11 1/16	36.3	16,400	681.0	鋼 FLAT BAR	150x 16	18.6		
	350x 100x 12 1/17	45.3	25,800	956.0		200x 16	25.1		
	400x 100x 12 1/18	50.1	35,200	1,190.0		200x 19	29.6		
型 鋼 SECTION	200x200x 8 1/3	33.0	8,596	619.0	球 平 型 BULB PLATE	200x 10	12.5	4,160	231.0
	250x200 10 1/16	44.8	15,257	900.0					
	300x200x 11 1/17	52.8	23,022	1,192.0					
U 型 SECTION					丸 棒 ROUND BAR	220x5500	3.6		
	60x 6	6.6		20.8					
	75x 6	8.0		30.1		76.30x7	12.0	106	2.57
	100x 6	10.4		49.3		89.10x7.6	15.5	155	3.02
					鋼 管 PIPE	114.50x8.6	22.4	450	3.89

I.Zに算入する板の寸法

平 鋼 ----- 420x 8

U型スチフナー ----- 420x 8

型钢(W.B DEPTH=125) --- 610x15

型 鋼 (W.B DEPTH=150) --- 610x15

その他 ----- 610x15

D-9

BREADTH

表 - 1

THICK-  
NESS

	100 (1250)	125 (1550)	150 (1900)	180 (2250)	200 (2500)	230 (2900)	250 (3100)	280 (3500)	300 (3750)
9	9.0	11.25	135	← SEC. AREA (CM <sup>2</sup> )					
	3125	579.6	960.7	← MOMENT OF INERTIA WITH PLATE (CM <sup>4</sup> )					
	11.1	13.9	16.7	← b/t					
10	10.0	12.5	15.0	18.0					
	3433	635.4	1051.8	1740.6					
	10.0	12.5	15.0	18.0					
10.5	10.5	13.125	15.75	18.9					
	358.6	663.4	1096.6	1813.0					
	9.5	11.9	14.3	17.1					
11	11.0	13.75	16.5	19.8	22.0				
	373.8	690.4	1140.9	1883.7	2783.2				
	9.1	11.4	13.6	16.4	18.2				
11.5	11.5	14.375	17.25	20.7	23.0				
	388.7	717.5	1184.3	1953.8	2891.3				
	8.7	10.9	13.0	15.7	17.4				
12	12.0	15.0	18.0	21.6	24.0				
	403.6	744.2	1227.1	2023.3	2997.4				
	8.3	10.4	12.5	15.0	16.7				
12.5			18.75	22.5	25.0	28.75			
			1269.5	2091.0	3102.6	4550.4			
			12.0	14.4	16.0	18.4			
13.5				24.5	27.0	31.05	35.75		
				2224.8	3309.9	4629.0	6037.2		
				13.3	14.8	17.0	18.5		
16						36.0	40.0	44.5	
						5561.0	6970.4	9471.3	
						14.4	15.4	17.5	
19							47.5	53.2	57.0
							7963.2	10794.7	12788.0
							13.2	14.7	15.8
22									66.0
									14461.4
									15.5

(1) ( )内数値は該当 FLAT BAR の使用寸法を MAX. 長さ ( b, Z = 0.08 )

(2) 表中数値は 上段 FLAT BAR の断面積 CM<sup>2</sup>

中段 板付断面二次モーメント CM<sup>4</sup>

下段 b/t b: F-B の幅 t: F-B の厚さ

(3) 板付断面二次モーメントは F-B の幅が 16.75mm 以上は 610×15、200mm 以上は 610×15 の钢板を含むものである。

(4) 寸法はなるべく使用しない。

D-10

0

1

2

3

4

5



## 1. Application

This standard regulates the sizes (width and length) for purchase of all steel plates to be employed to hull construction of general merchant ship except superstructure, and is applied to repair ship as much as possible.

## 2. Size Classification

## 2.1 Sketch Size

Size required is to be the one purchased, rounding size in consideration of size for extra cost only, provided that the size is generally within the range of Table 1.

## 2.2 Standard Size per ship

Size required is to be deemed to the standard size stipulated in 2.3 because of considerable numbers used for each ship owing to addition of:

- More than 10 pieces per size of the sketch-sized plates used around flat mid part, and
- A few pieces per size of the various-sized plates used for any parts to be made the same size as the above size,, provided that the size is generally within the range of Table 1.

<u>Weight (ton)</u>	<u>Width (meter)</u>	<u>Length (meter)</u>
less than 15	1,400 to 1,500	6,000 to 15,000

Table 1 Size Table of Sketch Size and Standard Size per Ship

Approval

Check

Alteration	0	1	2	3	4	5
Date						
Signature		D-11				

I S	SIZE OF STEEL PLATE FOR HULL CONSTRUCTION	SOT-A221011	<div style="border: 1px solid black; padding: 2px; display: inline-block;">           2 3         </div>
-----	--	-------------	--

2.3 General Standard Size

Standard sizes are regulated as shown in Table 2 in order to standardize a few pieces of purchase plates per size and to obtain the merits through the standardization, provided that the following may be accepted:

- Mild steel plates, thicker than 19.5mm or thinner than 5,5
- High grade mild steel plates, higher than B grade and inclusive
- Special steel plates such as high tensile steel plate, etc.

T (mm)	W (mm)	L (mm)
6 to 19	2,200	12,000
	2,800	

Table 2    General Standard Size of  
Steel Plate for Hull Structure

Approval							
Check							

Alteration	0	1	2	3	4	5
Date		D-12				

I S	SIZE OF STEEL PLATE FOR FULL CONSTRUCTION	SC7-A221011	3 / 3
-----	--	-------------	-------

### 3. Applicable Range of Size Classification

Table 3 shows the applicable range of steel plates for each Size Classification.

0 ..... Applicable , X ..... Unapplicable

Range	Size Classification	Sketch	Standard per ship	General Standard
- Skin, deck and double bottom - More than 19.5mm in thickness - Higher than B grade inclusive - Special steel such as high tensile		0*	0	0
- More than 10 pps. used for main and internal structure		X	0*	0
- Main and internal structure except the above		X**	0	0*

Table 3 Applicable Range of Size Classification of Steel Plates

Note: \* this is a main of standard of the applicable range.

\*\* The sketch size may be applied only for the special case after agreement made between Full Construction Work Shop and Design Department

Approval

Check

Alteration	0	1	2	3	4	5
------------	---	---	---	---	---	---

LIST OF IS-SOT-B  
WORK STANDARD



## APPENDIX E

### EXAMPLES OF IHI STANDARDS - SOT B5XXXXX

1. Extract from the detailed index for Group B5XXXXX - Working Standard for Piping
2. Example standard SOT B552001 - Standard Procedure for Inside Finishing of Pipe

NOTE: The material in this index is presented for instructional purposes only.

## WORKING STANDARD FOR PIPING

SOT-B5XXXXX

IS-NO	T I T L E	QTY	PMKS
B511001	Quality Control Standard For Cutting Length Of Steel Pipe	3	.
B511002	Quality Control Standard For Cutting Surface Of Steel Pipe	2	.
B511003	Quality Control Standard For Cutting Angle Of Steel Pipe	3	
B511004	Quality Control Standard For Cutting Groove Of Steel Pipe	3	.
B512001	Standard Of Marking And Cutting Procedure For Pipe	7	.
B512002	Standard Procedure For Pipe Coaster	11	
B520001	Allowance For Fitting Of Dresser Joint	3	.
B521001	Quality Control Standard For Ellipticity Of Cold Bending Pipe -	2	.
B521002	Quality Control Standard For Thickness Decrease- Rate Of Cold Bending Pipe	2	
B521003	Quality Control Standard For Elongation Of Steel Pipe By Cold Bending	3	
B521004	Quality Control Standard For Wrinkle Of Steel Pipe By Cold Bending	3	.
B521005	Quality Control Standard For Swell Of Steel Pipe By Cold Bending	2	.
B521006	Quality Control Standard For Scratch Of Steel Pipe By Cold Bending	2	.
B521007	Quality Control Standard For Bending Angle Of Steel Pipe By Cold Bending	2	.

## WORKING STANDARD FOR PIPING

SDT-B5XXXXX

IS-NO	T I T L E	QTY	RMKS
B522001	Standard Of Bending Procedure For Pipe	5	.
B531001	Quality Control Standard For Tolerance Of Butt Welded Joint	3	.
B531002	Quality Control Standard For Gap Of Butt Welded Joint	3	.
B531004A	Quality Control Standard For Angle Of Pipes Flange Assembly	3	.
B531005	Quality Control Standard For Alignment Of Flange Bolt Hole	2	.
B531006	Quality Control Standard For Assembly Length	3	.
B531007	Quality Control Standard For Assembly Of Branch- Pipe	4	.
B531008	Quality Control Standard For Clearance Between Pipe And Sleeve	6	.
B532001	Standard Of Assembly Procedure For Butt Welded Joint	4	.
B532002	Standard Procedure For Steel Flange Joint Assembly	6	.
B532003	Standard Procedure For Steel Branch Pipe Assembly	6	.
B532004	Standard Of Assembly Procedure For High- Pressure Pipe	6	.
B532005	Standard Of Assembly Procedure For Pvc Pipe	2	.
B532006	Standard Of Assembly Procedure For Model Pipe	3	.
B532007	Standard Procedure For Construction Of Model Pipe	5	.



## WORKING STANDARD FOR PIPING

SOT-B5XXXXX

IS-NO	T I T L E	QTY	RMKS
B541001	Quality Control Standard For Under-cut Of Welded Part	2	
B541002	Quality Control Standard For Fish-scale Of Welded Bead	2	
B541003	Quality Control Standard For Thickness Reinforcement Of Welded Bead	3	
B542001	Standard Of Butt Welding Procedure For High- Pressure Pipe	6	
B542002	Standard Procedure For Arc Welding Of Steel Pipe	10	
B542011	Standard Of Brazing Procedure For Copper Pipe & Brass Casting Flange	7	
B542012	Standard Of Brazing Procedure For Al-brass Pipe & Bronze Casting Flange	7	
B542013	Standard Of Brazing Procedure For Cu-ni Pipe & Bronze Casting Flange	7	
B542014	Standard Procedure For Assembly And Soldering Of Non-ferrous Pipe	8	
B542021	Standard Of Tig-welding Procedure For Copper Pipe & Brass Casting Flange	4	
B542022	Standard Of Tig-welding Procedure For Copper Pipe & Steel Flange	4	
B542023	Standard Of Tig-welding Procedure For Al-brass Pipe & Steel Flange	4	
B542024	Standard Of Tig-welding Procedure For Cu-ni Pipe & Steel Flange	4	

## WORKING STANDARD FOR PIPING

SOT-B5XXXXX

IS-NO	T I T L E	QTY	RMKS
B542025	Standard Procedure For Tig Welding Of Non-ferrous Pipe	6	.
B542026	Standard Of Tig Welding Procedure For Steel Pipe	9	✓
B542031	Standard Procedure For Co2 Arc Welding Of Steel Pipe	9	..
B542091	Quality Control Standard For Preheat Of Steel Pipe	2	
B551002	Quality Control Standard For Warp Of Flange Surface	3	.
B551003	Quality Control Standard For Warp Of Pipe After Branch Pipe Welding	3	.
B552001	Standard Procedure For Inside Finishishing Of Pipe	5	.
B552002	Standard Procedure For Face Finishishg Of Flange	3	
B561003	Quality Control Standard For Galvanizing Pipe	3	.
B562002	Standard Of Pipe Surface Preparation Befere Painting	10	
B572001	Standard Of Hydrotesting Procedure For Group-1 Pipe	3	.
B592001	Maintenance And InsPection Standard For Pipebnder	4	.
B592002	Standard Procedure For Pallet Works	8	.

## STEEL PIPE STANDARD FOR PIPING

107-35XXXXX

Q-NO	TITLE	QTY	PMS
B511001	Quality Control Standard For Cutting Surface Of Steel Pipe	3	.
B511002	Quality Control Standard For Cutting Surface Of Steel Pipe	2	.
B511003	Quality Control Standard For Cutting Angle Of Steel Pipe	3	.
B511004	Quality Control Standard For Cutting Groove Of Steel Pipe	3	.
B512001	Standard Of Marking And Cutting Procedure For Pipe	7	.
B512002	Standard Procedure For Pipe Coaster	11	.
B520001	Allowance For Fitting Of Dresser Joint	3	.
B521001	Quality Control Standard For Ellipticity Of Cold Bending Pipe -	2	.
B521002	Quality Control Standard For Thickness Decrease- Rate Of Cold Bending Pipe	2	.
B521003	Quality Control Standard For Elongation Of Steel Pipe By Cold Bending	3	.
B521004	Quality Control Standard For Wrinkle Of Steel Pipe By Cold Bending	3	.
B521005	Quality Control Standard For Swell Of Steel Pipe By Cold Bending	2	.
B521006	Quality Control Standard For Scratch Of Steel Pipe By Cold Bending	2	.
B521007	Quality Control Standard For Bending Angle Of Steel Pipe By Cold Bending	2	.

## MINIMUM STANDARD FOR PIPING

SOT-B53XXXX

ITEM NO	TITLE	QTY	PKGS
B532001	Standard Of Boring Procedure For Floor	5	
B531001	Quality Control Standard For Steel Flange Bolt Assembly	3	
B531002	Quality Control Standard For Gap Of Bolt welded Joint	3	
B531004A	Quality Control Standard For Angle Of Pipes Flange Assembly	3	
B531005	Quality Control Standard For Alignment Of Flange Bolt Hole	2	
B531006	Quality Control Standard For Assembly Length	3	
B531007	Quality Control Standard For Assembly Of Branch- Pipe	4	
B531008	Quality Control Standard For Clearance Between Pipe And Sleeve	6	
B532001	Standard Of Assembly Procedure For Bolt Welded Joint	4	
B532002	Standard Procedure For Steel Flange Joint Assembly	6	
B532003	Standard Procedure For Steel Branch Pipe Assembly	6	
B532004	Standard Of Assembly Procedure For High- Pressure Pipe	6	
B532005	Standard Of Assembly Procedure For Pvc Pipe	2	
B532006	Standard Of Assembly Procedure For Model Pipe	3	
B532007	Standard Procedure For Construction Of Model Pipe	5	

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## WORKING STANDARD FOR PIPING

SOT-B5XXXXX

S-NO	T I T L E	QTY	RMKS
B541001	Quality Control Standard For Under-cut Of Welded Part	2	
B541002	Quality Control Standard For Fish-scale Of Welded Bead	2	
B541003	Quality Control Standard For Thickness Reinforcement Of Welded Bead	3	
B542001	Standard Of Butt Welding Procedure For High- Pressure Pipe	6	
B542002	Standard Procedure For Arc Welding Of Steel Pipe	10	
B542011	Standard Of Brazing Procedure For Copper Pipe & Brass Casting Flange	7	
B542012	Standard Of Brazing Procedure For Al-brass Pipe & Bronze Casting Flange	7	
B542013	Standard Of Brazing Procedure For Cu-ni Pipe & Bronze Casting Flange	7	
B542014	Standard Procedure For Assembly And Soldering Of Non-ferrous Pipe	8	
B542021	Standard Of Tig-welding Procedure For Copper Pipe & Brass Casting Flange	4	
B542022	Standard Of Tig-welding Procedure For Copper Pipe & Steel Flange	4	
B542023	Standard Of Tig-welding Procedure For Al-brass Pipe & Steel Flange	4	
B542024	Standard Of Tig-welding Procedure For Cu-ni Pipe & Steel Flange	4	

DATE '77-07 P 5

## WORKING STANDARD FOR PIPING

SOT-B5XXXXX

0







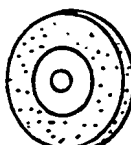
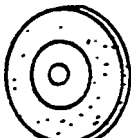

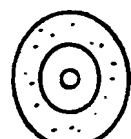
E

Q-

S

B542025	Standard Procedure For Tig. Welding Of Non-ferrous Pipe	6	✓
B542026	Standard Of Tig Welding Procedure For Steel Pipe	9	✓
B542031	Standard Procedure For Co2 Arc Welding Of Steel Pipe	9	✓
B542091	Quality Control Standard For Preheat Of Steel Pipe		
B551002	Quality Control Standard For Warp Of Flange Surface	3	✓
B551003	Quality Control Standard For Warp Of Pipe After Branch Pipe Welding	3	✓
B552001	Standard Procedure For Inside Finishishing Of Pipe	5	✓
B552002	Standard Procedure For Face Finishing Of Flange	3	✓
B561003	Quality Control Standard, For Galvanizing Pipe	3	✓
B562002	Standard Of Pipe Surface Preparation Befere Painting	10	✓
B572001	Standard Of Hydrotesting Procedure For Group-1 Pipe	3	✓
B592001	Maintenance And Inspection Standard For Pipebnder	4	✓
B592002	Standard Procedure For Pallet Works	8	✓

Is	Standard Procedure for Inside Finishing of Pipe	SOT-B552001
<p>1. Application</p> <p>This standard prescribes about procedure and each process of inside pipe finishing.</p> <p>NOTE: This is applied for non-ferrous pipes.</p> <p>2. Work standard</p>		
Procedure	Work Detail	Notice
1. Preparation	(1) Tools and protectors to be used	Work table , round table, grinder, (angle & baby type), feeler gauge, under-cut gauge, air drilling machine, reamer, lights, pipe clamp, eye protectors, mask, gloves, intermediate shaft
	(2) Grinder safety check	<p>1. Grease grinder before air hose connection.</p> <p>2. Idle grinder for three minutes in the inspection box, in order to make sure that whetstone is strong enough.</p>
	(3) Whetstone replacement	<p>1. Must be replaced when the whetstone wear up to the center label.</p> <p>2. Replacement must be done by a qualified person.</p> <p>3. After replacement, check to see if its security fastener is going back to (2) - 2.</p>
	(4) Pipe fixing	<p>1. Use vice for small pipes.</p> <p>2. Work on the table for easy inspection of the inside.</p> <p>3. Fix pipes applying clamps.</p>
	(5) Reconfirmation of finishing grade	Reconfirm finishing grade by piece drawing prior to work start.
E-9		

Is		Standard Procedure for Inside Finishing of Pipe		SOT-B552001	
2. Finishing	(1) Tool selection	Application of Tools & Drills			
		Nom. Dia.	Tool	Drill	Appl icati on
		15ø (MM)	File		Flange inside bead & inside pipe
			Baby Grinder	 Ultra Hardened	(incl udi ng saddl e part)
			Air Drill - ing Machi ne	 Reamer	
		25ø ? 50ø	File		Insi de Pi pe (i ncl udi ng saddl ed part)
			Air Drill - ing Machi ne	 Reamer	
			Baby Grinder	 	
		65ø  E-10	Baby Grinder	 	Insi de Pi pe (i ncl udi ng saddl ed part)
			Angl e Grinder (over 250ø)		



IS	Standard Procedure for Inside Finishing of Pipe	SOT-B552001
	(2) Fini shi ng process	<p><u>Filing</u></p> <ol style="list-style-type: none"> <li>1. Do not file without handle.</li> <li>2. Clean the file before usage by wire brush.</li> <li>3. Use rough surface file.</li> </ol>
		<p><u>Grinding</u></p> <ol style="list-style-type: none"> <li>1. Work on the table.</li> <li>2. Butt welded part.               <ol style="list-style-type: none"> <li>a. Grind lower half</li> <li>b. Grind the rest after rolling 180°</li> </ol> </li> </ol> <div data-bbox="964 798 1549 1058"> </div> <ol style="list-style-type: none"> <li>3. Use intermediate shaft in grinding at deep inside pipe.</li> <li>4. Start rotation after insert into pipe. Do not approach with rotation.</li> </ol>
		<p><u>Reaming</u></p> <ol style="list-style-type: none"> <li>1. Fix a pipe by vice.</li> <li>2. Approach reamer slowly to avoid damage on reamer.</li> <li>3. Check smoothness stopping occasionally.</li> <li>4. Use round file for small pipes on which reaming is difficult.</li> </ol>
	(3) Cleani ng	<p>After finishing process, do not forget to clean inside. Either blow air or stand a pipe and give a few impacts.</p>

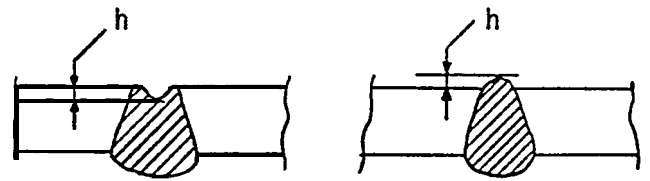
## 3. Confirmation

## (1) Final check

1. According to "Standard of inside  
pipe finishing)

SOT-B551001

Grade	Standard	Allowance
A	--	$h = 0 \sim 1.0$
B	$h = 0.5 \sim 2.5$	--
c	Not specified	



2. Check using under-cut-gauge or  
feller gauge case by case.

## APPENDIX F

### EXAMPLE OF IHI STANDARDS IN USE

1. **Extract from the detailed index for**  
Group S0T A347XXX Electrical Fitting  
Production Design, Fitting Work
2. Design office drawing on "Practice  
for Electrical Installation"

210 GRAPHY

APPROVING  
REMARKS  
DATE

PAGE

# CONTENTS

1. ARRANG OF ELEC. EQUIPMENTS (GENERALLY) IN CABIN
2. ARRANG OF ELEC. EQUIPMENTS (GENERALLY) IN MACH. SPACE
3. INSTALLATION METHOD OF ELEC. CABLE & APPLIANCE
4. FITTING METHOD OF ELEC. CABLE WAY TO HULL STRUCTURE
5. SHAPE OF ELEC. CABLE ENTRY TO ELEC. EQUIPMENT
6. EARTHING METHOD OF NON CURRENT CARRYING-PARTS OF ELEC. EQUIPMENT & CABLE

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MANAGER	DEPUTY MANAGER	CHIEF	DEPUTY CHIEF	DATE
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				241 - 258
PRACTICE FOR ELECTRICAL INSTALLATION				CLASSIFICATION
				LR
				SCALE
				DRAWING NO.
				K 5 7 0 0 2 0 0
APR 26 1974				



Ministry of Defense, Japan

Ships Division Elec. Fitting Design Sec., Ships Design Dept., Aichi

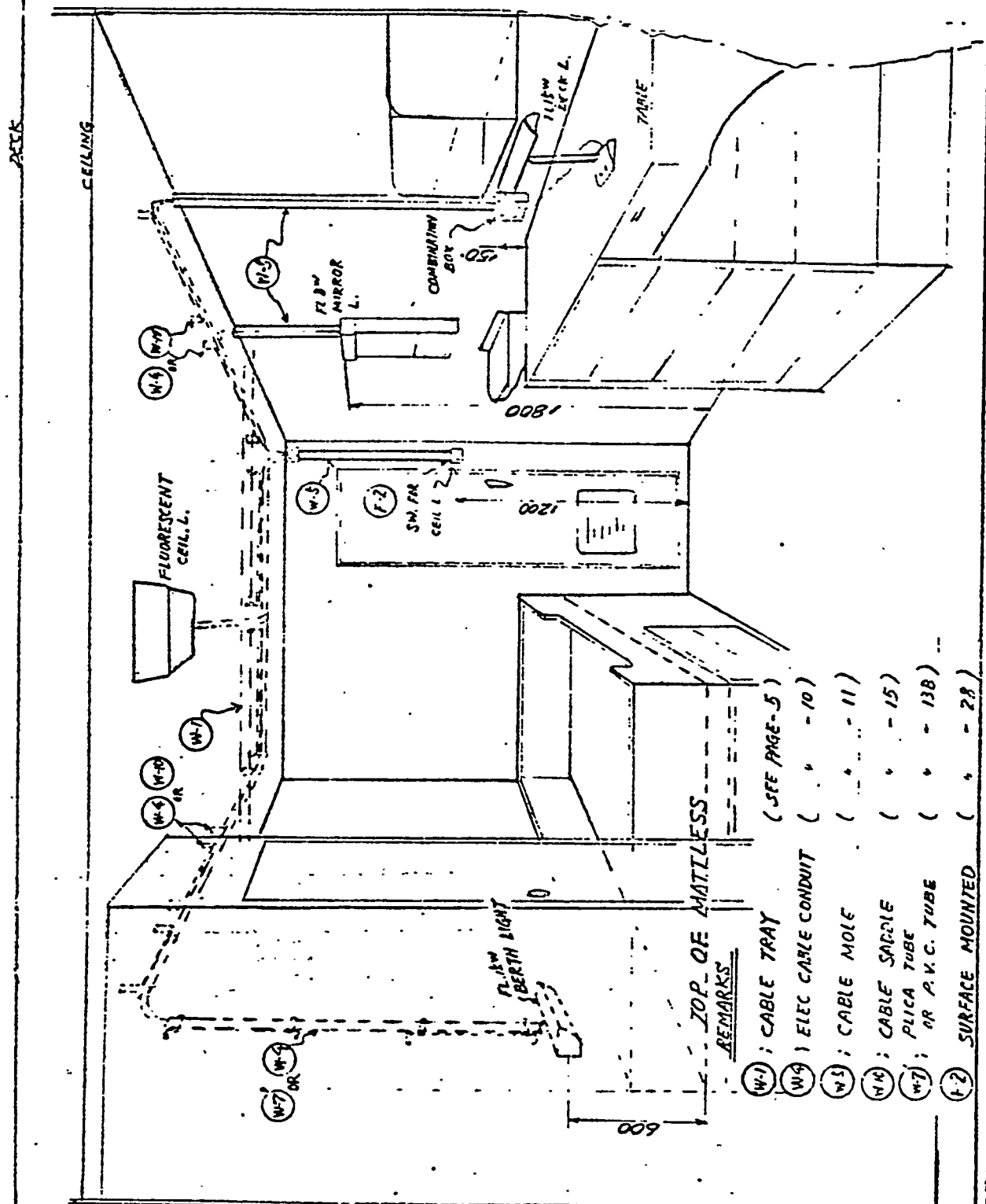
APPROV

F-1

TOTAL NO OF SHEETS 27

ARRANGEMENT OF ELECTRIC EQUIPMENTS ( GENERALLY )

APPLICATION IN CABIN



TOP OF MATLESS

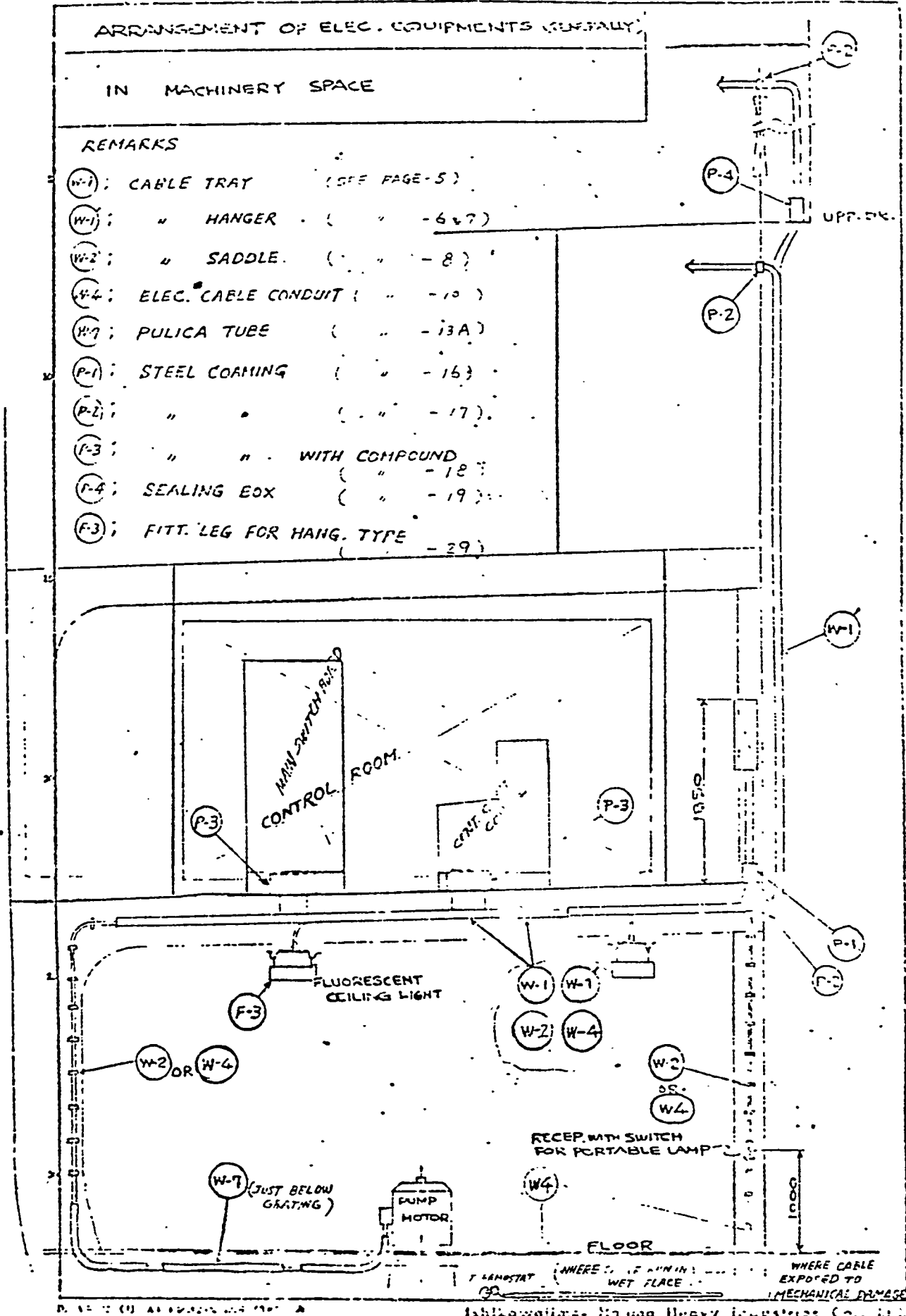
REMARKS

- W-1 ; CABLE TRAY (SEE PAGE-5)
- W-2 ; ELEC CABLE CONDUIT ( - 10 )
- W-3 ; CABLE MOLE ( - 11 )
- W-4 ; CABLE SADDLE ( - 15 )
- W-5 ; PLICA TUBE ( - 138 )
- W-6 ; OR P.V.C. TUBE ( - 28 )
- W-7 ; SURFACE MOUNTED ( - 28 )

ARRANGEMENT OF ELEC. EQUIPMENTS (GROSSLY)  
IN MACHINERY SPACE

REMARKS

- (W-1) : CABLE TRAY (SEE PAGE-5)
- (W-1) : " HANGER ( " - 6 & 7)
- (W-2) : " SADDLE ( " - 8)
- (W-4) : ELEC. CABLE CONDUIT ( " - 10)
- (W-7) : PULICA TUBE ( " - 13A)
- (P-1) : STEEL COATING ( " - 16)
- (P-2) : " " ( " - 17)
- (P-3) : " " WITH COMPOUND ( " - 18)
- (P-4) : SEALING BOX ( " - 19)
- (F-3) : FITT. LEG FOR HANG. TYPE - 29)



IS

船舶内用電気配線取付規則  
INSTALLATION METHOD OF ELECTRIC  
CABLE AND WIRING

SOT-A34700/

電線

電線 2

電線 5

電線 1

電線 1

電線 1

電線 1

電線 1

電線 1

電線 2

電線 3

電線 4

電線 5

電線 4

電線 3

電線 1

計 25

## 1. 適用範囲

この基準は船内の電線布設要領、電線貫通要領および配線、電路器具の取付要領について規定する。

## (1) SCOPE

This standards are regulated to installation method of electric cable way & support, penetration and fitting detail of wiring on board.

## 2. 備考

(1) 番船えの適用；第2原紙を利用して使用すること。

- (2) 関連設計基準；(A) SOT-A347002 船殻構造えの配線取付け要領  
(B) SOT-A347003 電気機器えの配線出入口の形  
(C) SOT-A347004/5/6 電気品の非可燃金属部の接地  
(D) SOT-A347007 防火区画可成貫通要領

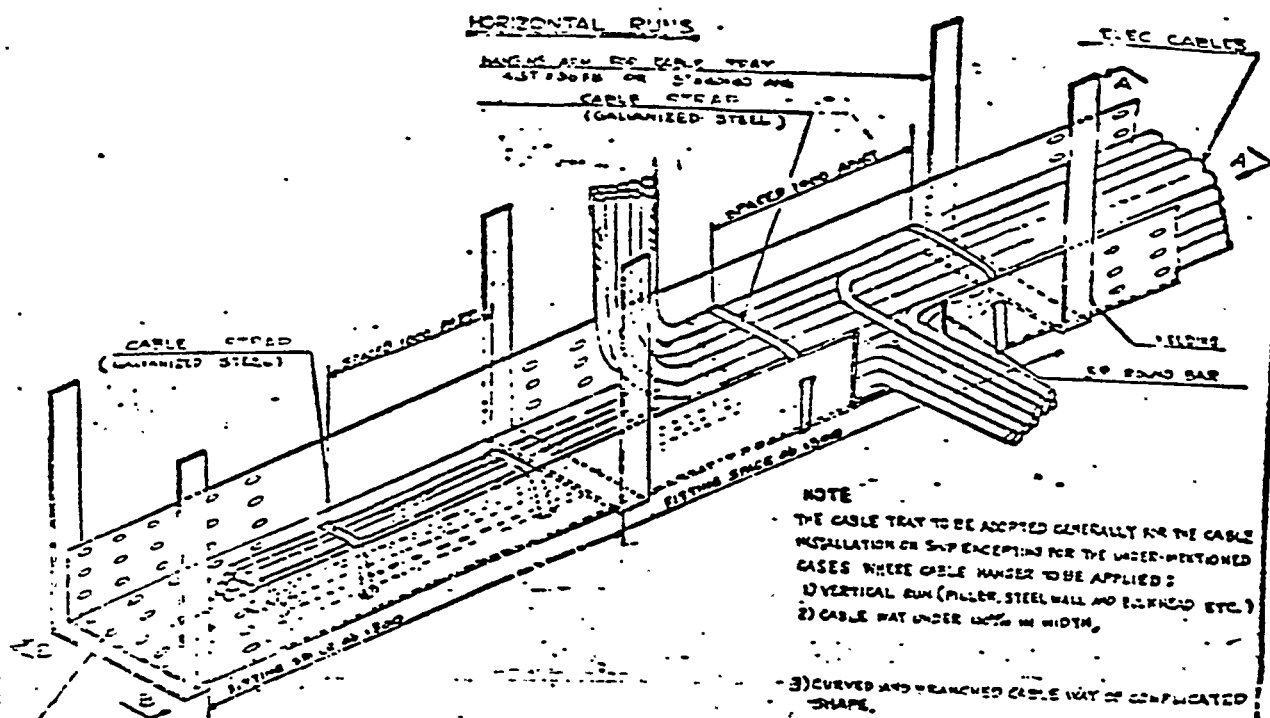
## 3. 目録

## CONTENTS

SYMBOL	DESCRIPTION	PAGE	SYMBOL	DESCRIPTION	PAGE
(W-1)	WIRE WAY AND SUPPORT (1)	5	(P-1)	PENE TRATION (1)	15
(W-1)	" (2)	6, 7	(P-2)	" (2)	17
(W-2)	" (3)	8	(P-3)	" (3)	18
(W-3)	" (4)	9	(P-4)	" (4)	19
(W-4)	" (5)	10	(P-5)	" (5)	20
(W-5)	" (6)	11	(P-6)	" (6)	21
(W-6)	" (7)	12	(P-7)	" (7)	22
(W-7)	" (8)	13A	(P-8)	" (8)	23
(W-7)	" (8)	13B	(P-1)	FITTING DETAIL OF WIRING DEVICE	27
(W-8)	" (9)	14	(P-2)	" (2)	28
(W-10)	" (10)	15	(P-3)	" (3)	29

発行所	1	2	3	4	5
発行所	1	2	3	4	5
発行所	1	2	3	4	5

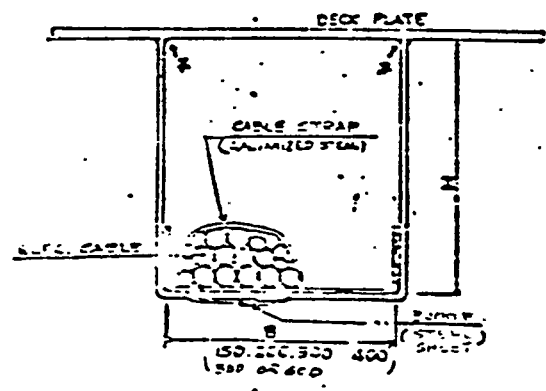
WIRING AND SUPPORTS - (1)			
SYMBOL	REMARKS	APPLICATION	REMARKS
(M1)	EXPOSED AND CONCEALED	ALL INTERIOR WIRING SUCH AS MAIN NEXT SPACE, STORE SPACE, ACCOMMODATION AND SIMILAR SPACES	MAIN WIRING



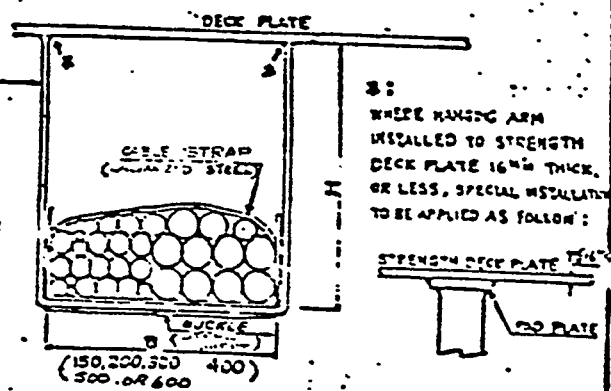
CABLE TRAY  
(GALVANIZED STEEL)  
PUNCHED SHEET  
162

LINE 457 AND 305 CABLE TRAY

**B - B SECTION**



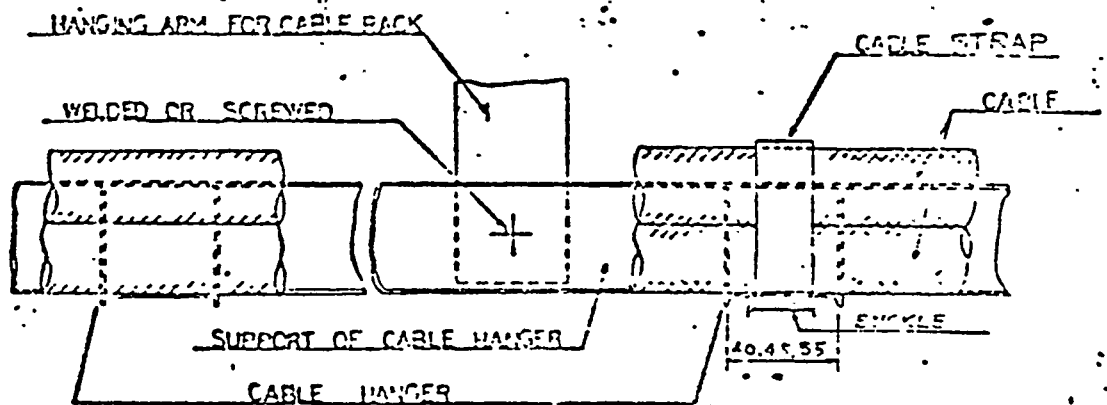
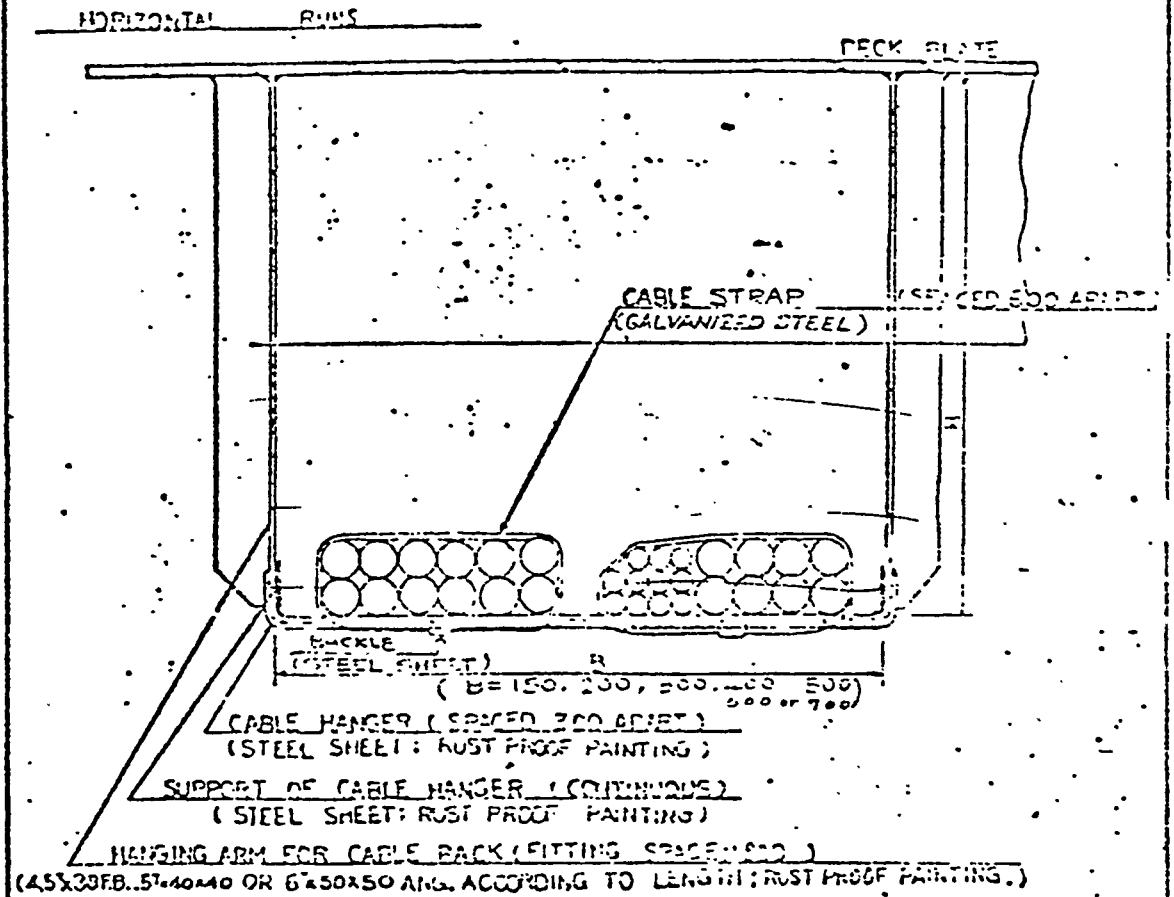
**A - A SECTION**





WIREWAY AND SUPPORTS - (2)

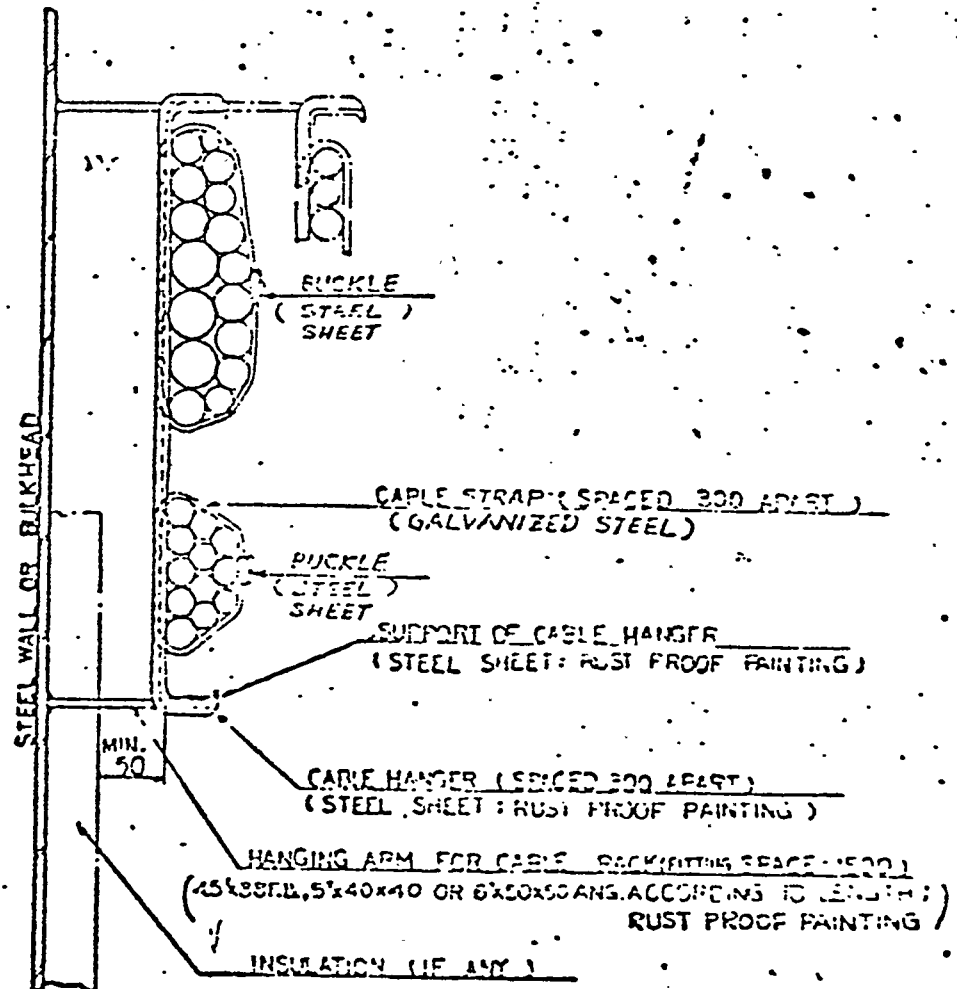
SYMBOL	WORKS	APPLICATION	REMARKS
(W-1)	EXPOSED AND CONCEALED	ALL INTERIOR WIREWAY SUCH AS MACHINERY SPACE, STORE SPACE AND ACCOMMODATION. ( CURVED AND BRANCHED CABLE WAY OF COMPLICATED SHAPE )	WIREWAY ( PARTIALLY )



WIREWAY AND SUPPORTS - (2)

SYMBOL	WORKS	APPLICATION	REMARKS
W-1	EXPOSED AND CONCEALED	ALL INTERIOR WIREWAY SUCH AS MACHINERY SPACE, STORE SPACE AND ACCOMMODATION.	MAIN WIREWAY

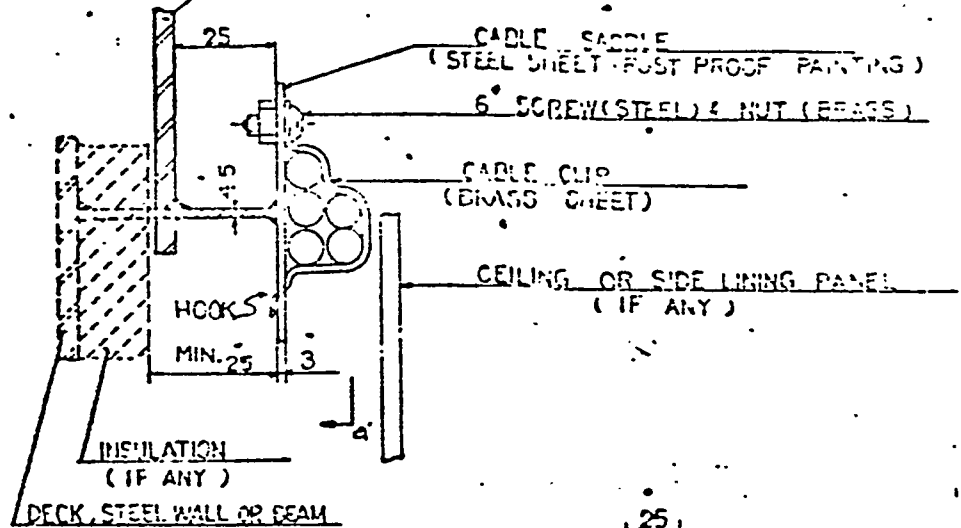
VERTICAL RUN



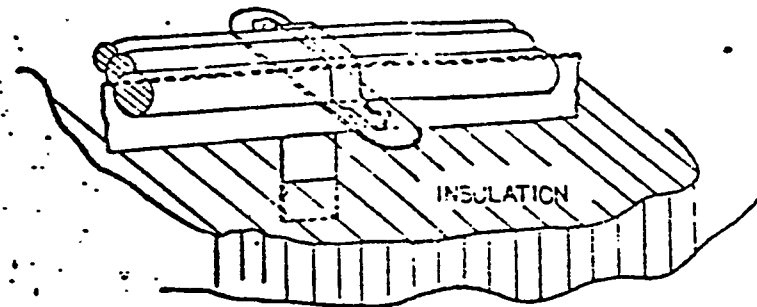
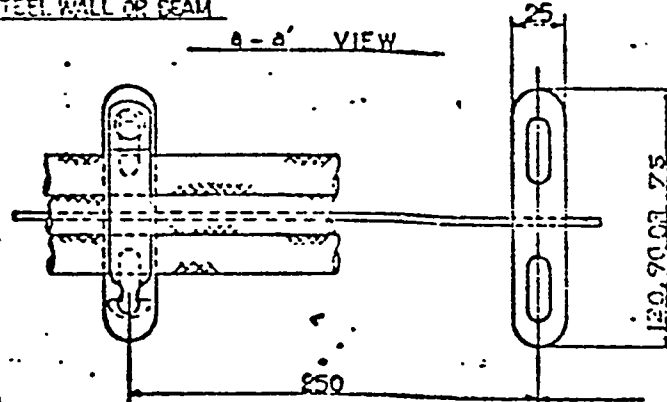
WIREWAY AND SUPPORTS - (3)

SYMBOL	WORKS	APPLICATION	REMARK
W-2	EXPOSED AND CONCEALED	ALL INTERIOR WIREWAY SUCH AS MACHINERY SPACE, STORE SPACE AND ACCOMMODATION.	SMALL WIREWAY

DECK, STEEL WALL OR BEAM

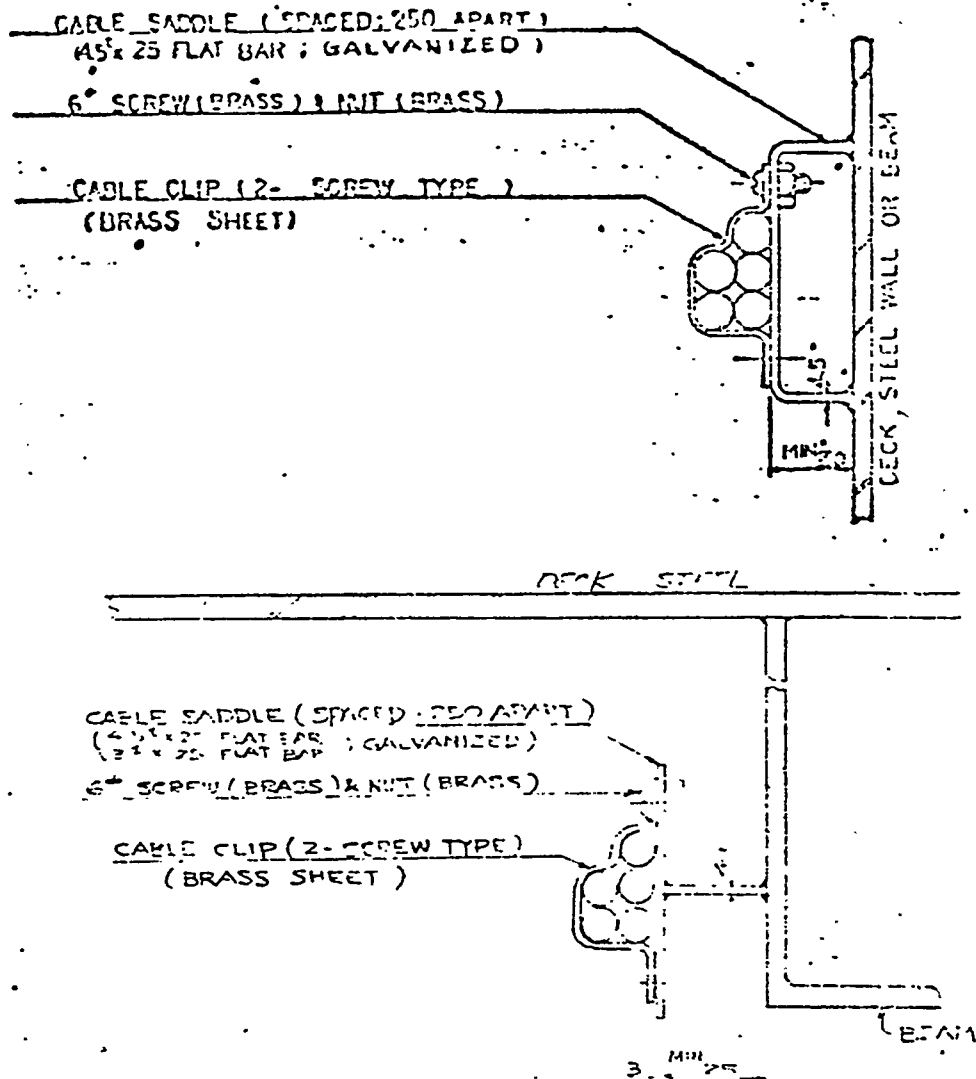


a-a' VIEW



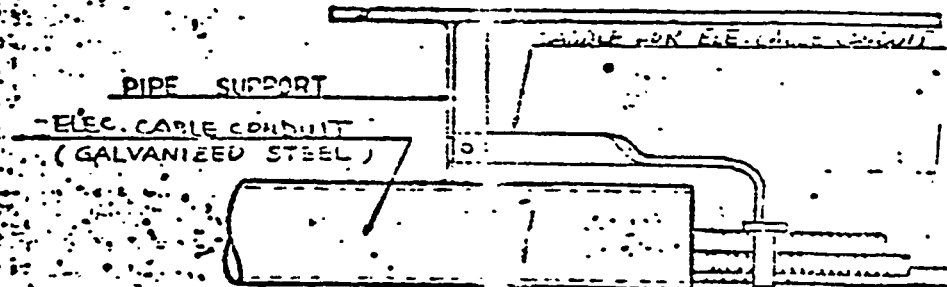
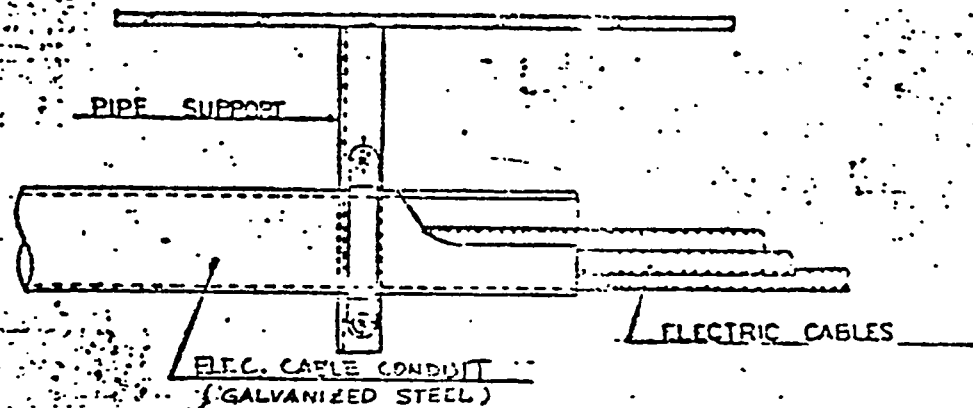
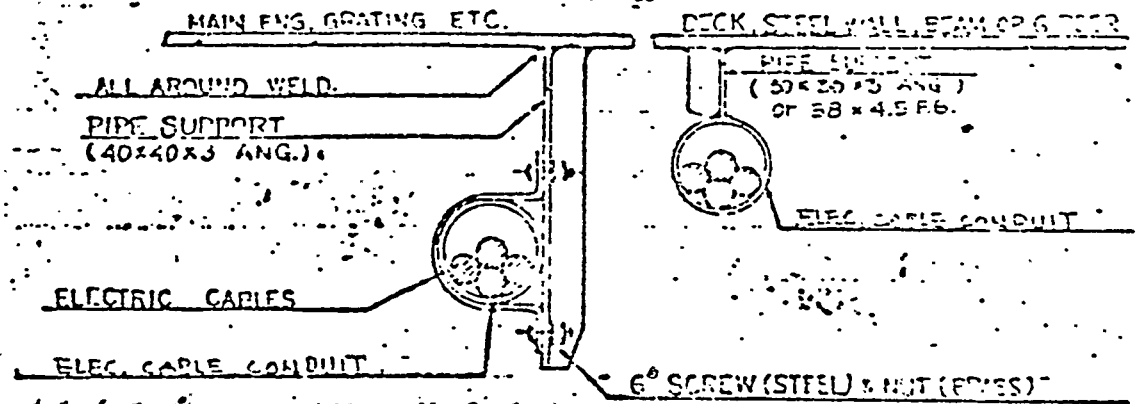
## WIREWAY SUPPORTS - (4)

SYMBOL	WORKS	APPLICATION	REMARKS
W-3	EXPOSED	WHERE EXPOSED TO THE WEATHER	



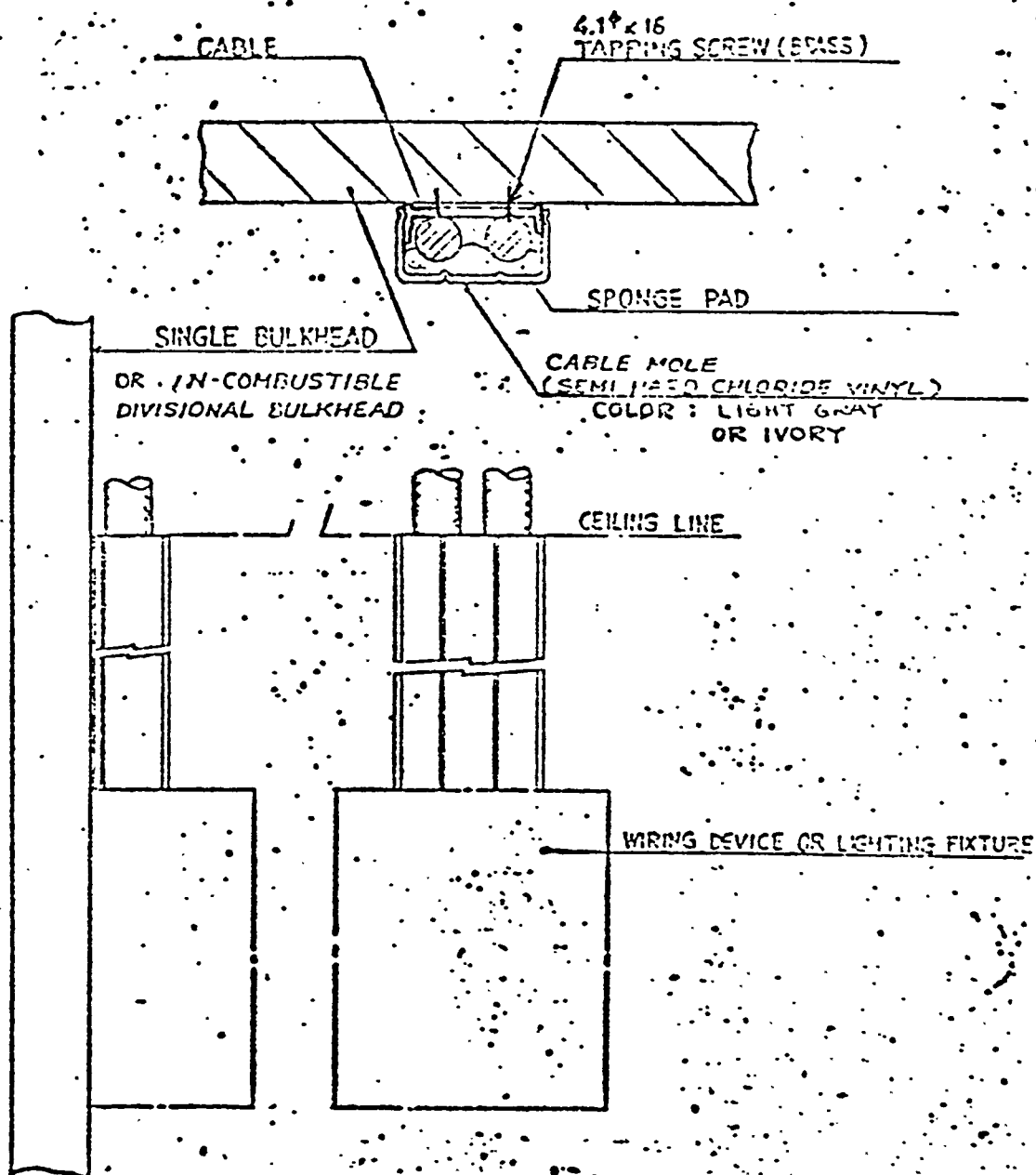
## WIREWAY AND SUPPORTS - (5)

SYMBOL	WORKS	APPLICATION	REMARKS
W-4	CONDUIT WORK	ALL INTERIOR WIREWAY SUCH AS MACHINERY SPACE, STORE SPACE AND ACCOMMODATION.	SMALL WIREWAY



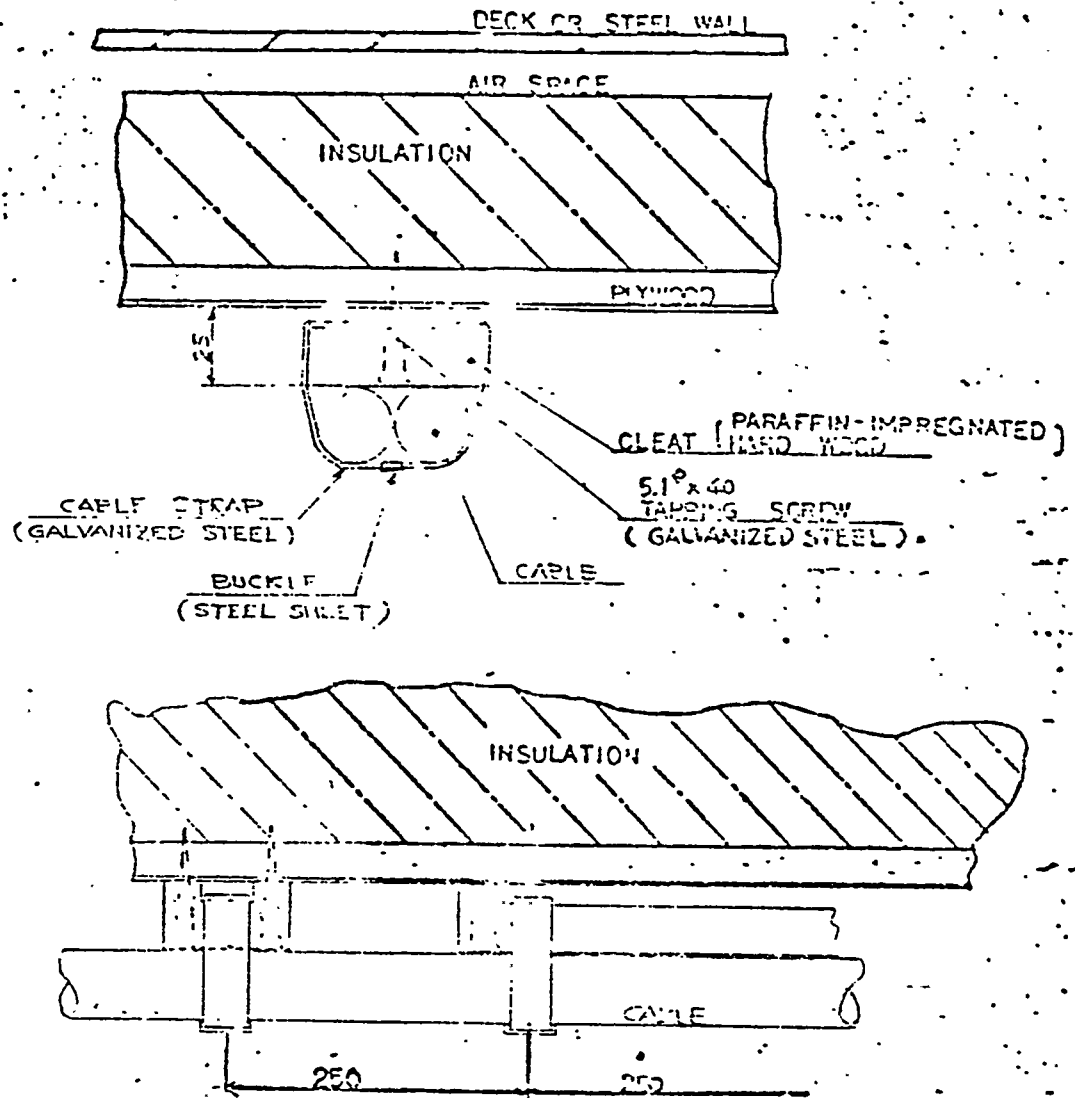
## WIREWAY AND SUPPORTS - (6)

SYMBOL	WORKS	APPLICATION	REMARKS
W-5	SURFACE WIRING AND CAPPED	IN LIVING QUARTER WHERE CABLE CANNOT BE CONCEALED	



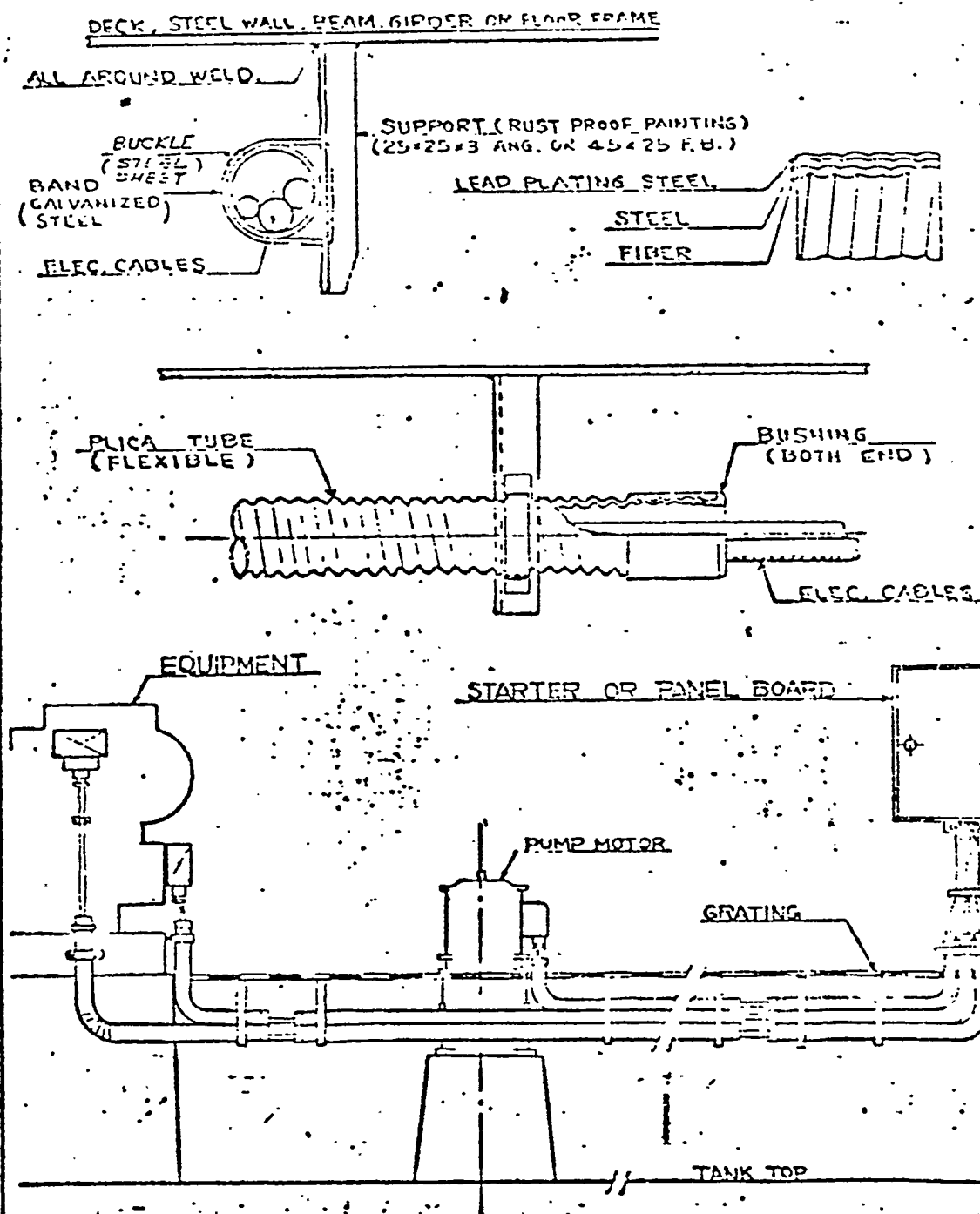
## WIREWAY AND SUPPORTS - 171

SYMBOL	WORKS	APPLICATION	REMARKS
(W-6)	EXPOSED	REFRIGERATED PROVISION CHAMBER	



# WIREWAY AND SUPPORTS - (8)

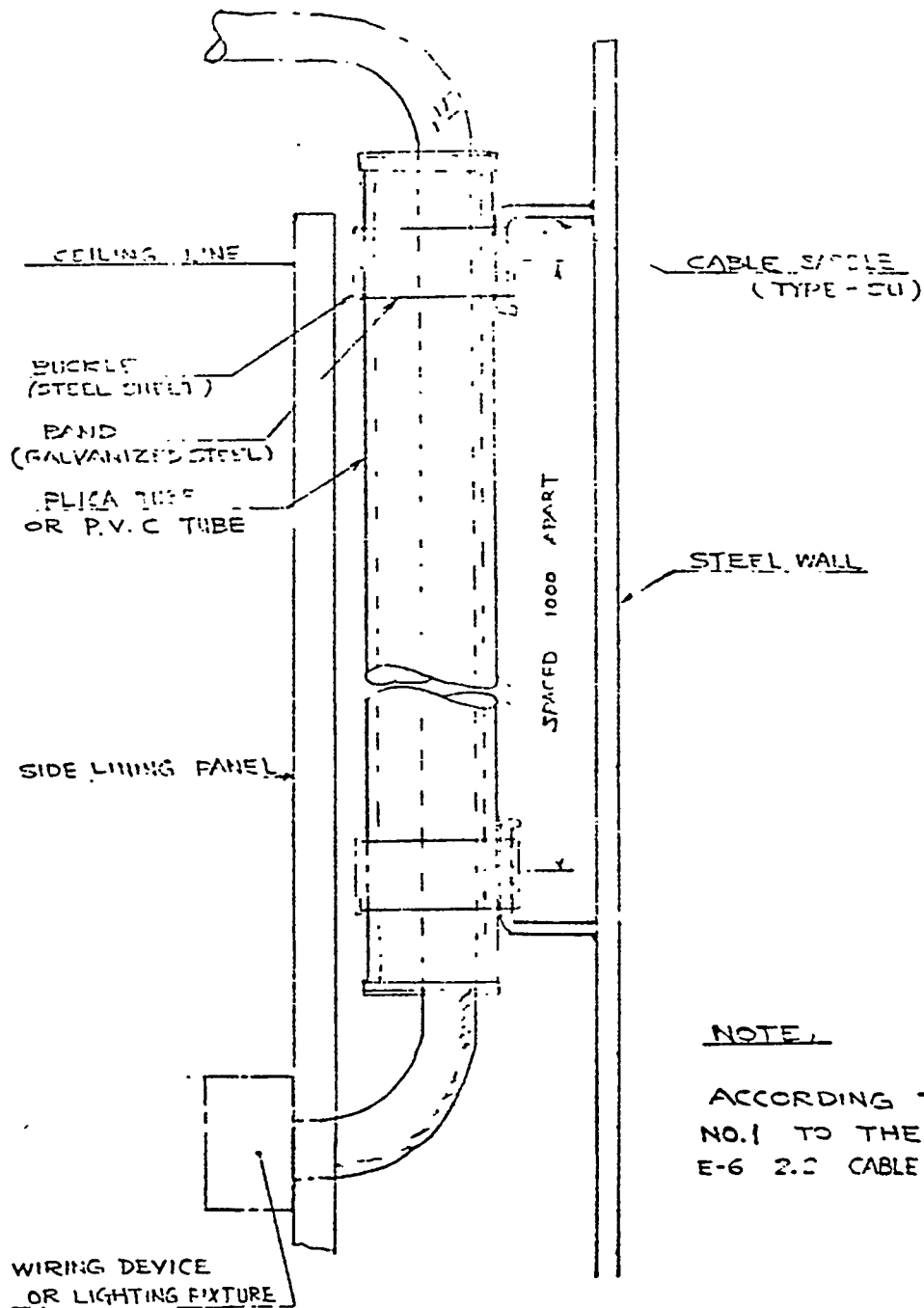
SYMBOL	WORKS	APPLICATION	REMARKS
W-7	FLEXIBLE CONDUIT (PLICA TUBE)	UNDER FLOOR WIRING AND ATTACHMENT WIRING ON EQUIPMENT	





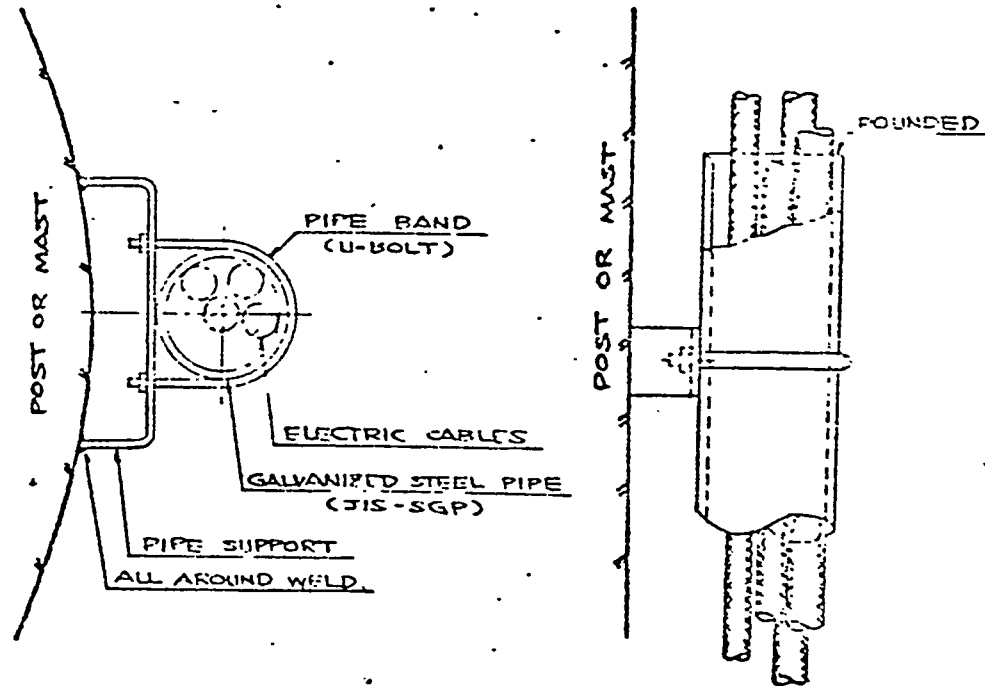
# WIREWAY AND SUPPORTS -(S)

SYMBOL	WORKS	APPLICATION	REMARKS
W-7	PLICA TUBE OR P.V.C. TUBE (CONCEALED)	WHERE CABLE 1/10 SPACE BETWEEN STEEL WALL AND SIDE LINING PANEL	



## WIREWAY AND SUPPORTS - (9)

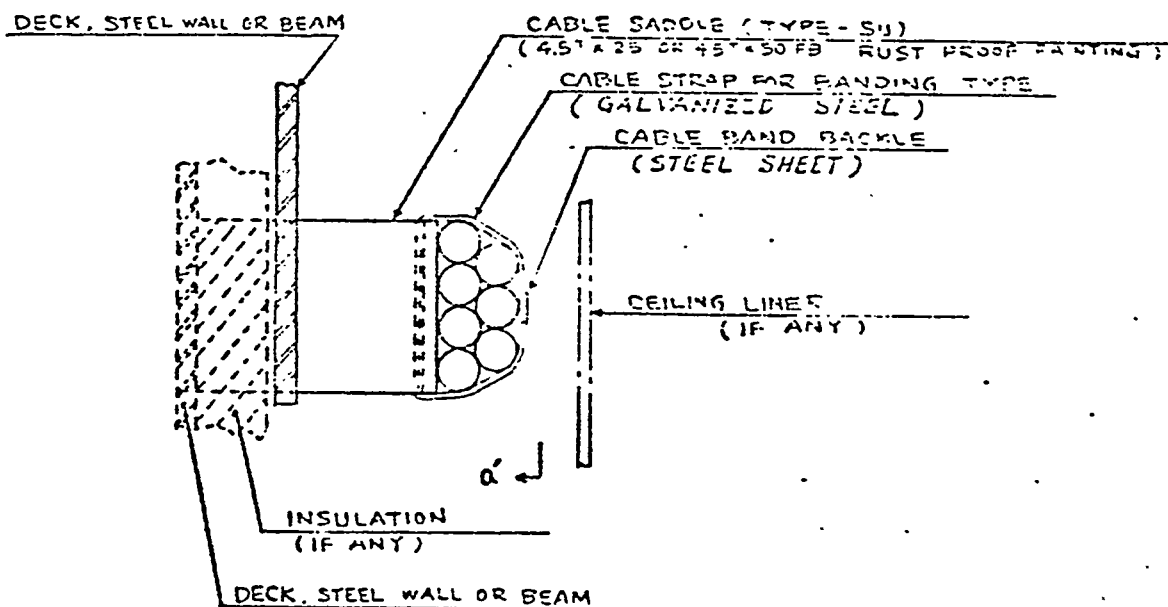
SYMBOL	WORKS	APPLICATION	REMARK
W-8	PIPE WORK	WHERE THE CABLE EXPOSED TO EXCEPTIONAL RISK OF MECHANICAL DAMAGE ON WEATHER DECK SUCH AS MAST, POST ETC.,	SMALL WIREWAY



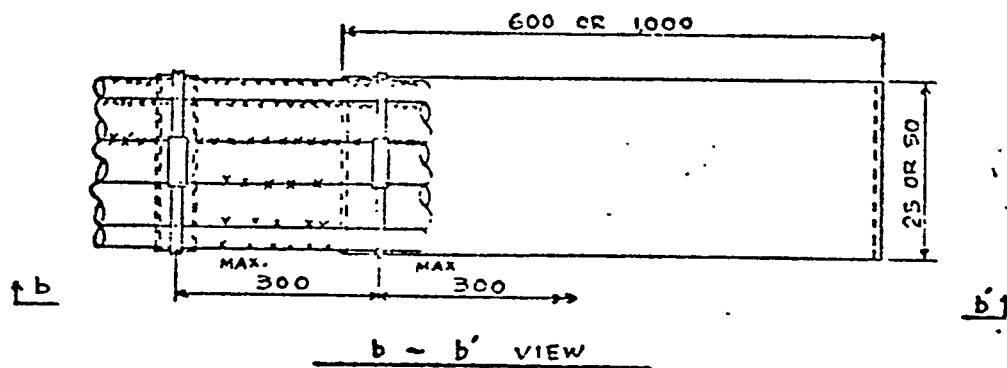
F

## WIREWAY AND SUPPORTS - (10)

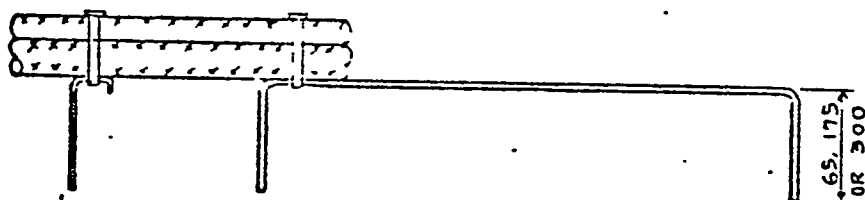
SYMBOL	WORKS	APPLICATION	REMARKS
W-10	EXPOSED AND CONCEALED	ALL INTERIOR WIREWAY SUCH AS STORE SPACE AND ACCOMMODATION EXCEPT SYMBOL MARK (W-10)	SMALL WIREWAY



a - a' VIEW

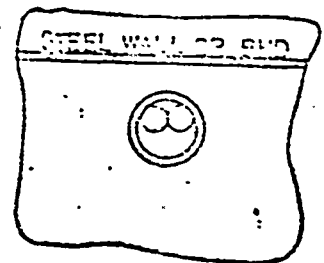
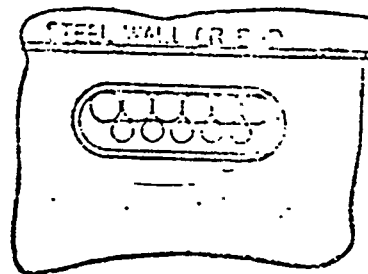
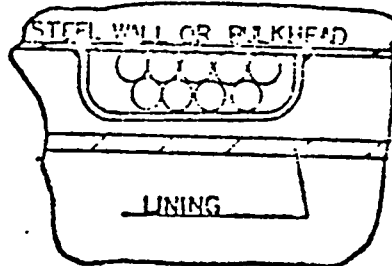
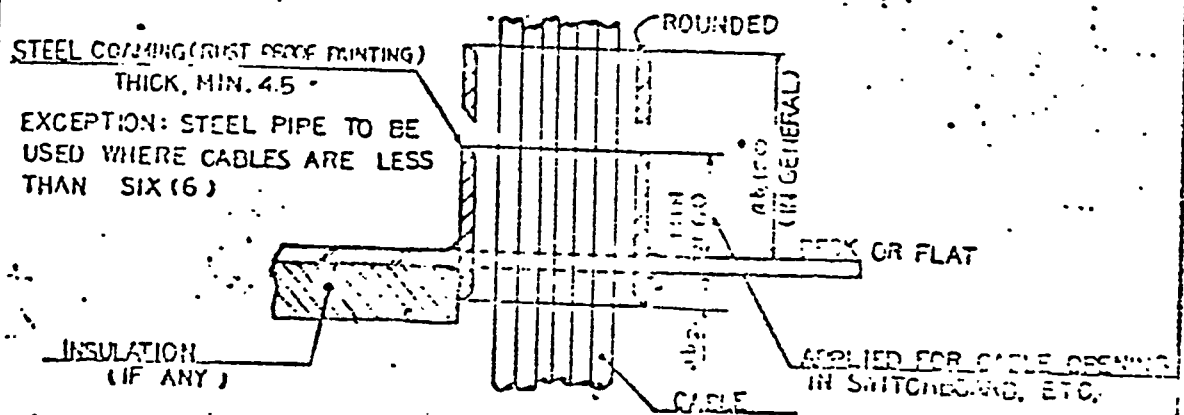


b - b' VIEW



## PENETRATION - (1)

SYMBOL	WORKS	APPLICATION	REMARKS
(P-1)	STEEL COAMING •	WHERE CABLES PASS THROUGH NON-WATERTIGHT DECK OR FLAT, ETC.	



## PENETRATION - (2)

SYMBOL	WORKS	APPLICATION	REMARKS
(P-2)	STEEL COAMING	WHERE CABLES PASS THROUGH NON-WATERTIGHT WALL BULKHEAD, BEAM, STIFFENERS, ETC.	

STEEL COAMING (RUST PROOF PAINT)  
(ROUND OR OVAL TYPE)

SC

ROUNDED

MIN 3/2"

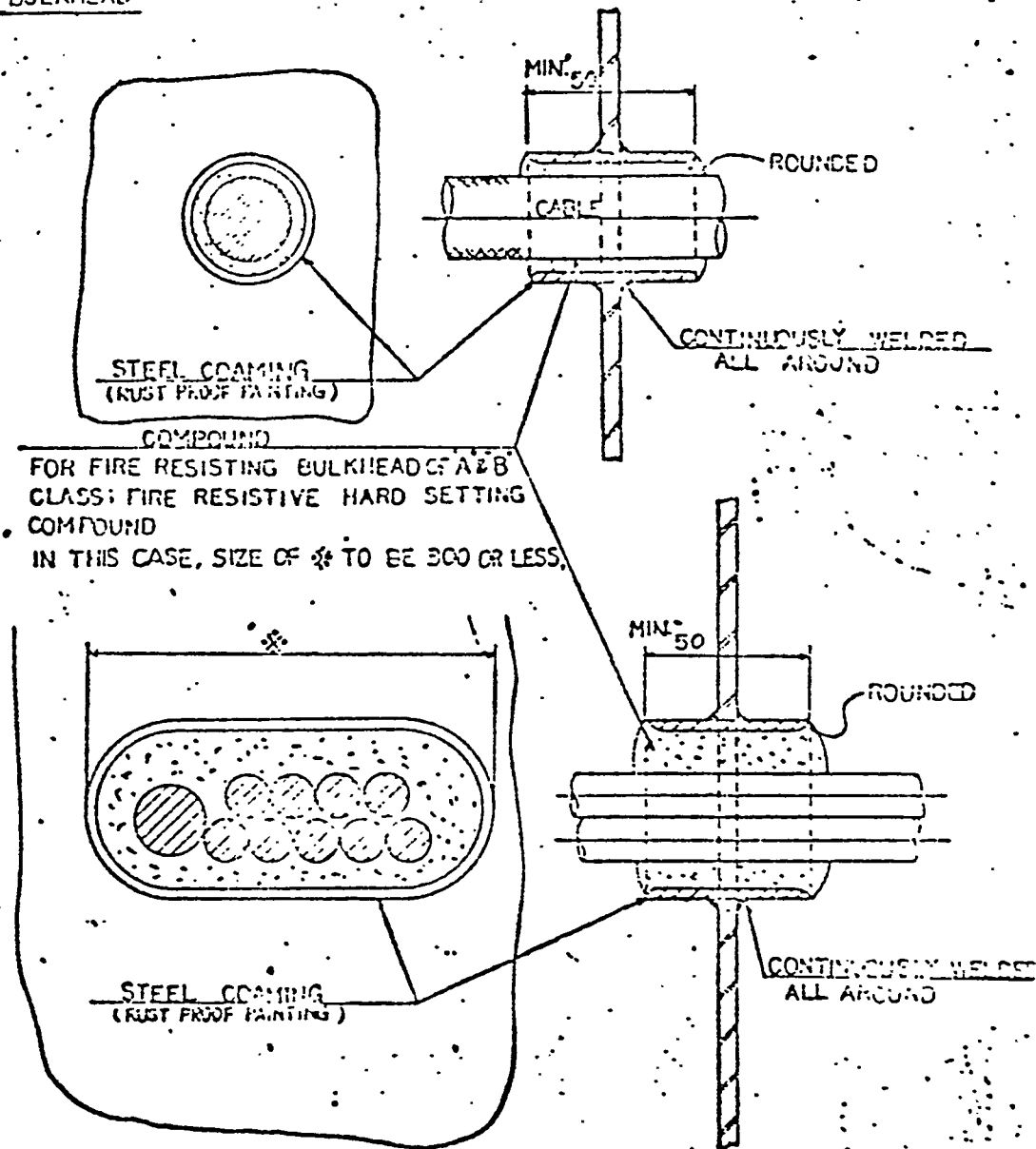
WELDED

NON-WATERTIGHT BULKHEAD, BEAM,  
STIFFENER, ETC.

ROUND OUT BY GRINDER

## PENETRATION - 131

SYMBOL	WORKS	APPLICATION	REMARKS
(P-3)	COAMING WITH COMPOUND	WHERE CABLES PASS THROUGH BULKHEAD OR DECK PLATE EXCEPT EXPOSED TO WEATHER	

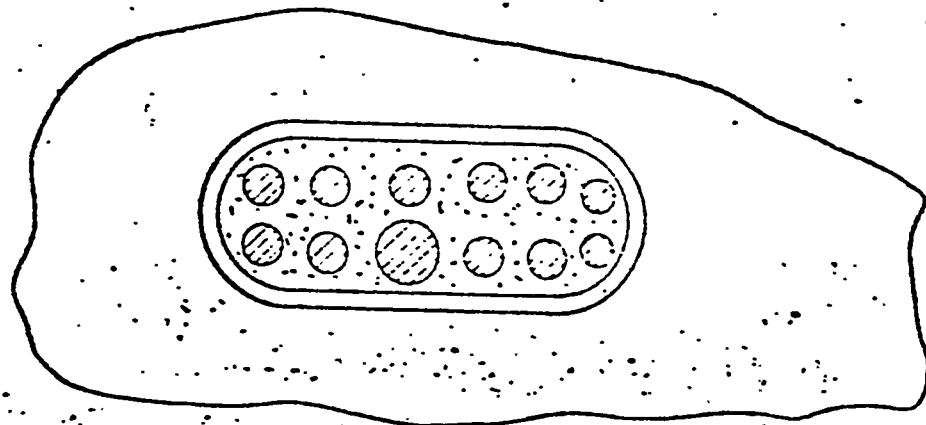
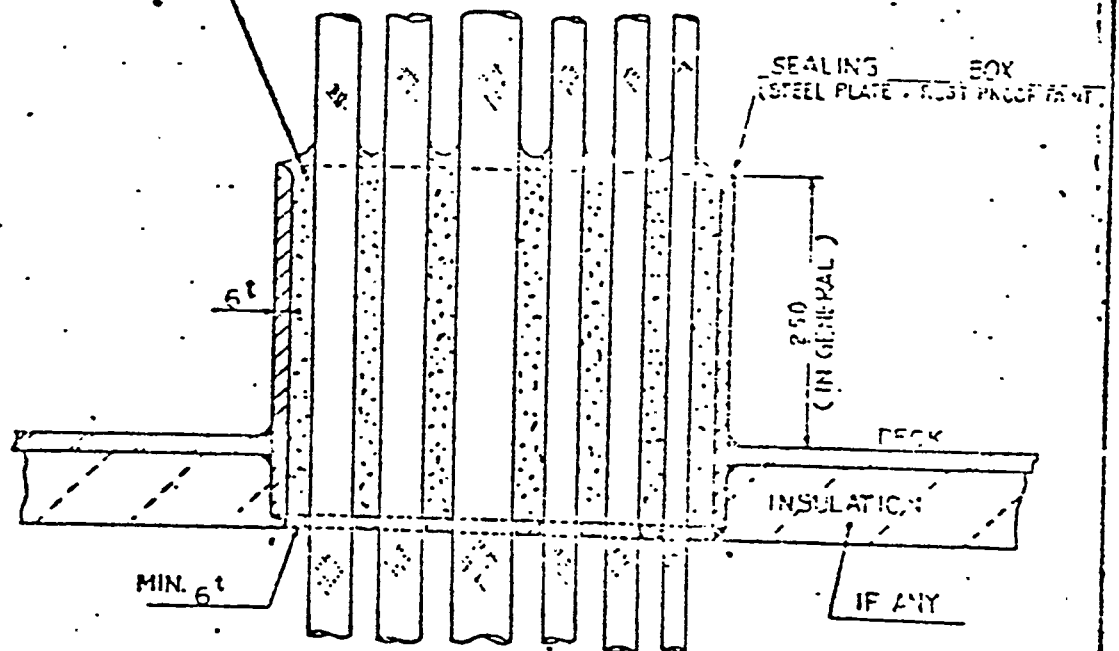
BULKHEADDECK

CONSTRUCTION OF COAMING SHALL CONFORM TO (P-1)  
AND STUFFED WITH SUITABLE COMPOUND.

# DESTRUCTION - (1)

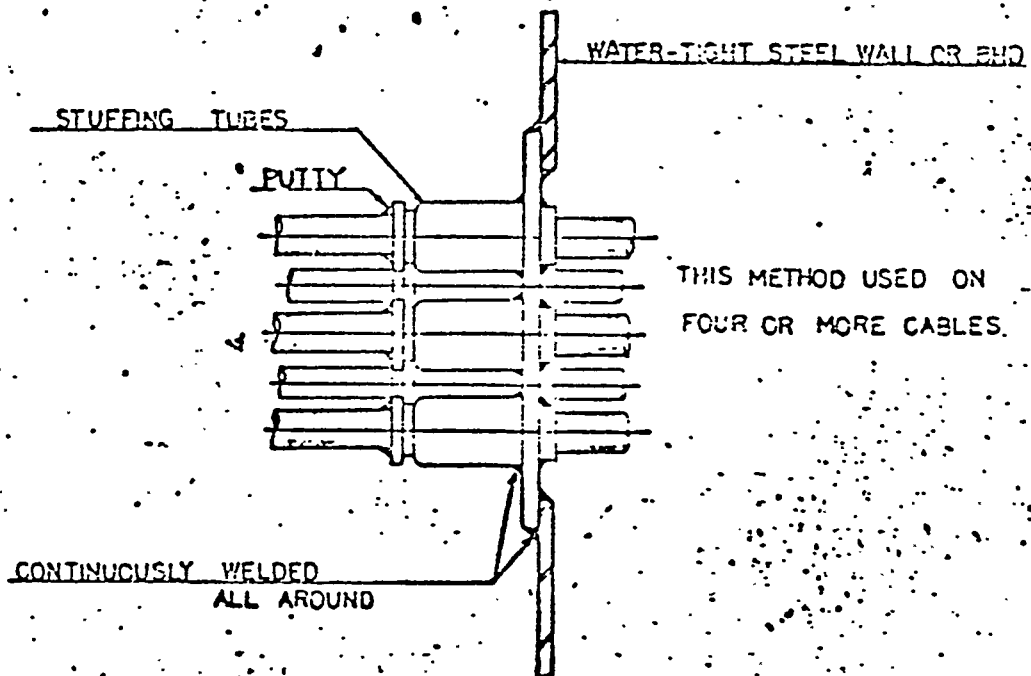
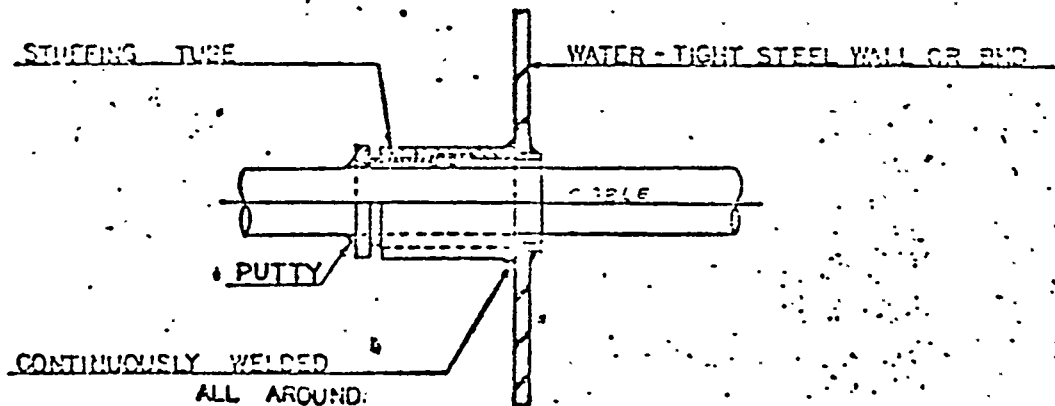
SYMBOL	WORKS	APPLICATION	REMARKS
P-4	SEALING BOX	WHERE CABLES PASS THROUGH DECK IMMEDIATELY ABOVE ENGINE AND BOILER ROOM	

STUFFED WITH FIRE RESISTIVE HARD-SETTING COMPOUND



# PENETRATION - (P)

SYMBOL	WORKS	APPLICATION	REMARKS
P-5	WATERTIGHT STUFFING TUBE	WHERE CABLES PASS THROUGH WATERTIGHT BULKHEAD.	

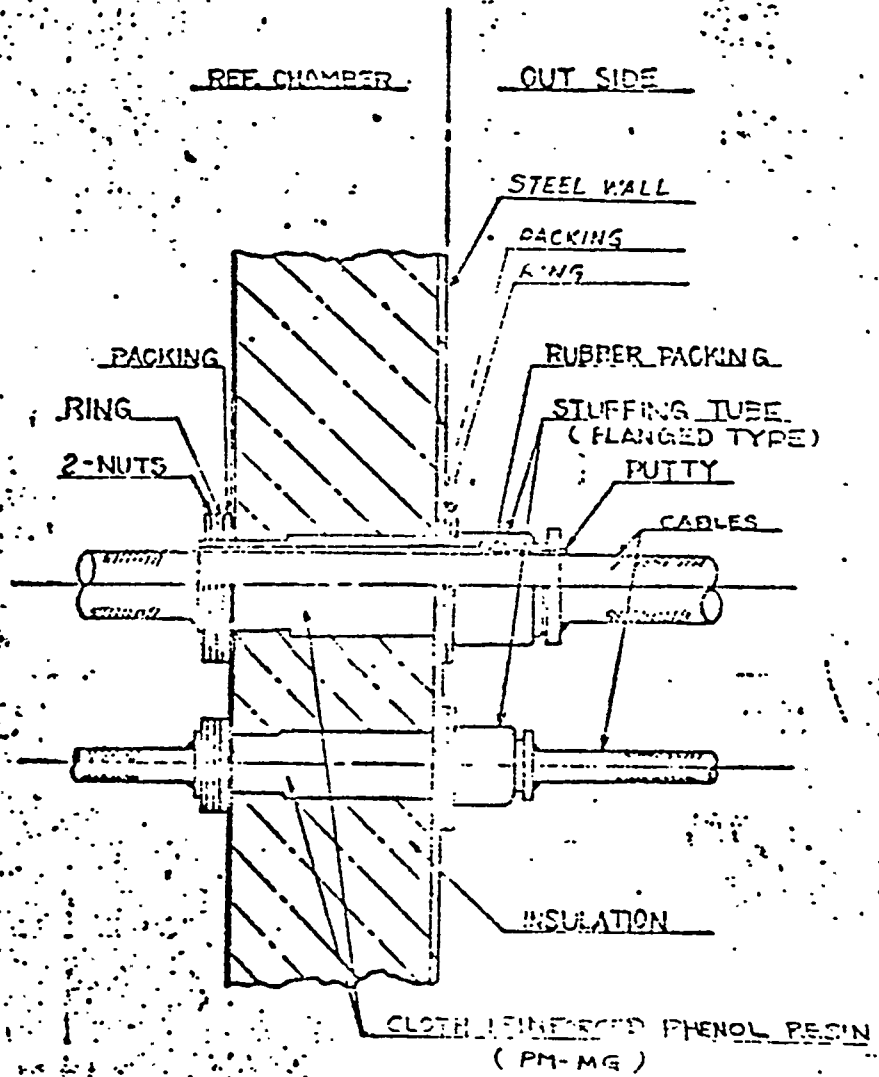





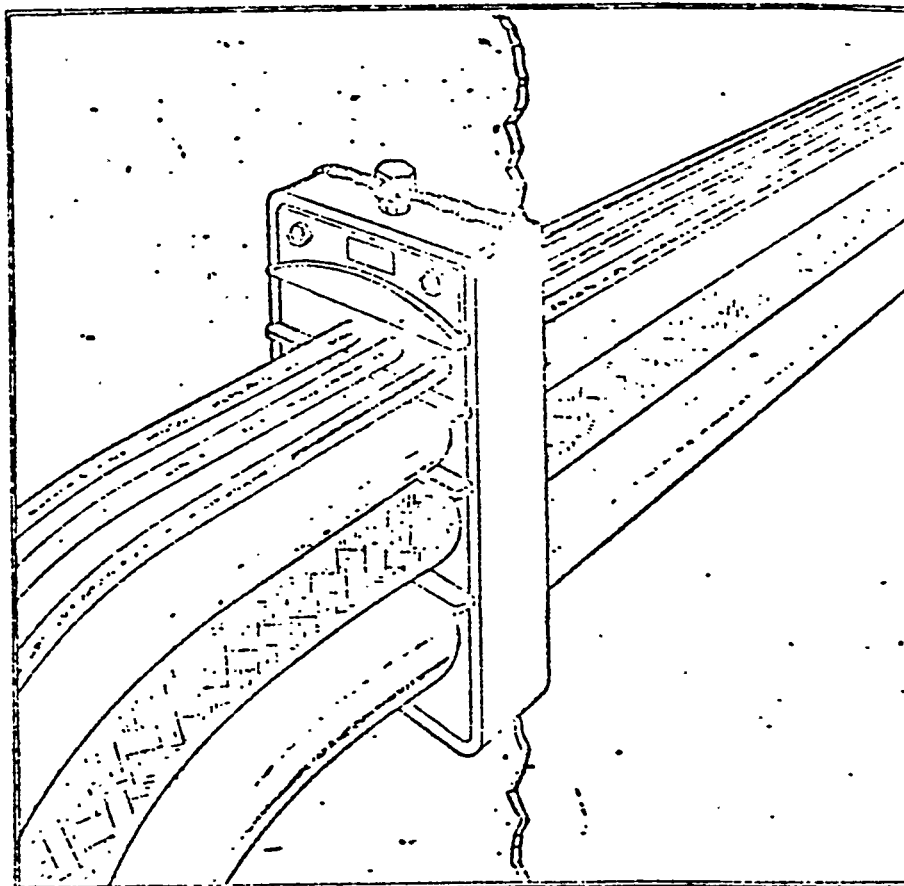


PENETRATION - (7)

SYMBOL	WORKS	APPLICATION	REMARKS
(P-7)	STUFFING TUBE WITH PIPE	WHERE CABLE PASS THROUGH REFRIGERATED SPACE INSULATION	



PENETRATION - (8) 1/4			
SYMBOL	WORKS	APPLICATION	REMARKS
MCT 	MULTI-CABLE TRANSIT	WHERE CABLES PASS THROUGH WATER TIGHT BULKHEAD.	



## Multi-Cable Transit Complies with Government Specifications

- U. S. Military Specifications MIL-P-15553C  
PERFORMANCE TEST (Thermocycling)
- U. S. Military Standard 157  
VIBRATION TEST
- U. S. Military Specification MIL-S-901C  
SHOCK TEST
- U. S. Military Standard MIL-STD-103D  
WATER TIGHT TEST
- International Convention for Safety of Life at Sea  
FIRE TEST (STANDARD)
- ASTM-E119-61  
FIRE TEST

NOTE: All Multi-Cable Transit test units contained an assortment of plain and armored marine cables.

PENETRATION - (8) 2/4			
SYMBOL	WORKS	APPLICATION	REMARKS

## What is Multi-Cable Transit

Tecrona Multi-Cable Transit is a proven fireproof, water and airtight method of passing electrical cables from one compartment to another.

### PRINCIPAL FEATURES

- **Fire and Smoke Proof**  
Special elastomer blocks form an incombustible seal around burning cables, filling in all parts destroyed by fire and choking off any passage of fire or smoke.
- **Water and Airtight**  
Elastomer blocks provide a water and airtight seal.
- **Shock and Vibration Proof**  
A special "stay plate" (see page 5) prevents dislodgment of components.
- **Thermal Efficiency**  
Effective in temperatures between minus 320° and plus 1700° F.
- **Flexibility**  
Cables can be added, removed, or sizes changed in minutes.
- **Economy**  
Cable pulling time and cost is reduced drastically by inserting cables through wide open transit frames rather than stuffing tubes.
- **Space Saving**  
A large number of cables can be grouped in a small area.
- **Cable Protection**  
Large aperture and elastomer blocks prevent chafing and shredding of cables inherent in other devices.
- **Positive Visual Inspection**  
Danger of a poor sealing job is eliminated. All units may be visually inspected to assure proper seal against fire, water, air, and dust.
- **Durability**  
Inserts are unaffected by liquids, chemicals, oils, gases, etc.

## Applications

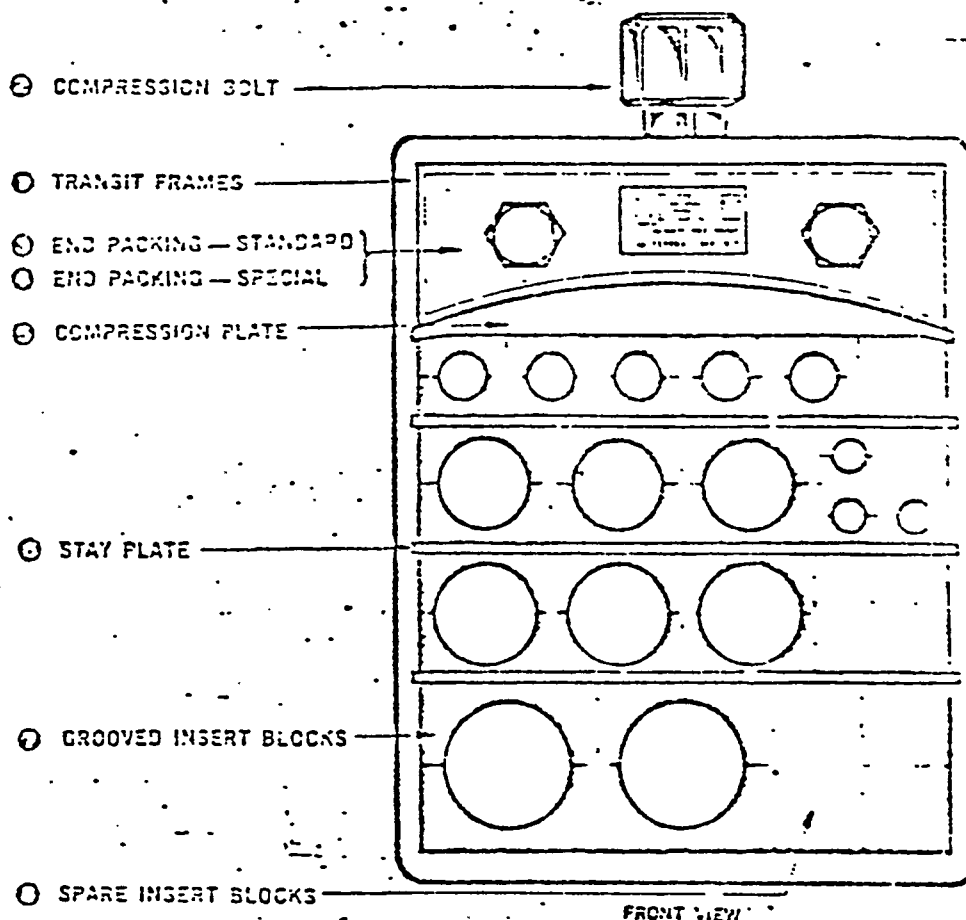
### MARITIME

- Watertight, airtight, fireproof bulkhead penetrations.
- Weatherdeck penetrations.
- Fire and explosion-proof protection in critical areas.
- Electrical equipment penetrations.
- Thermal barrier for all type penetrations.
- Sound and vibration-free entries for cables and pipe.

PENETRATION - (8)  $\frac{3}{4}$ 

SYMBOL	WORKS	APPLICATION	REMARKS

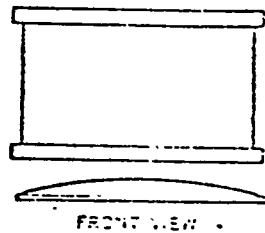
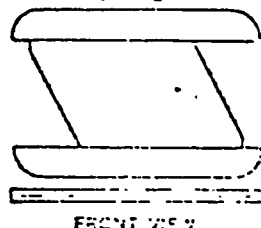
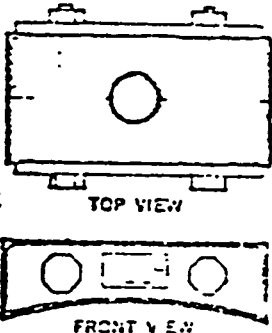
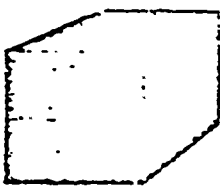
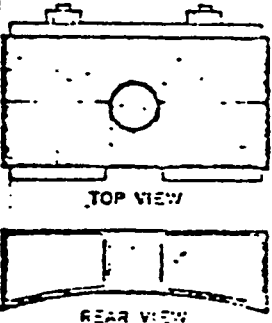
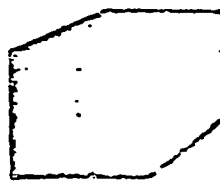
## Components of the Multi-Cable Transit



### COMPONENT MATERIALS

Transit Frames are fabricated either of steel, aluminum, or steel alloys. Compression Plates are steel or aluminum castings. Compression Bolts are available in stainless steel or galvanized. Stay Plates are made of steel or aluminum. Insert Blocks and End Packings are made from a specially formulated fire-proof elastomer.

PENETRATION - (8)  $\frac{1}{4}$ 

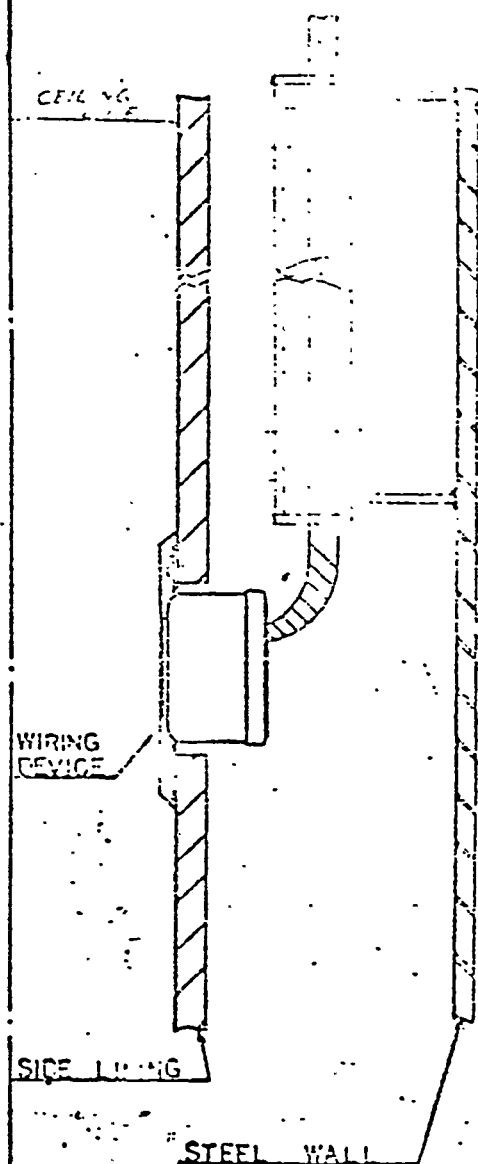
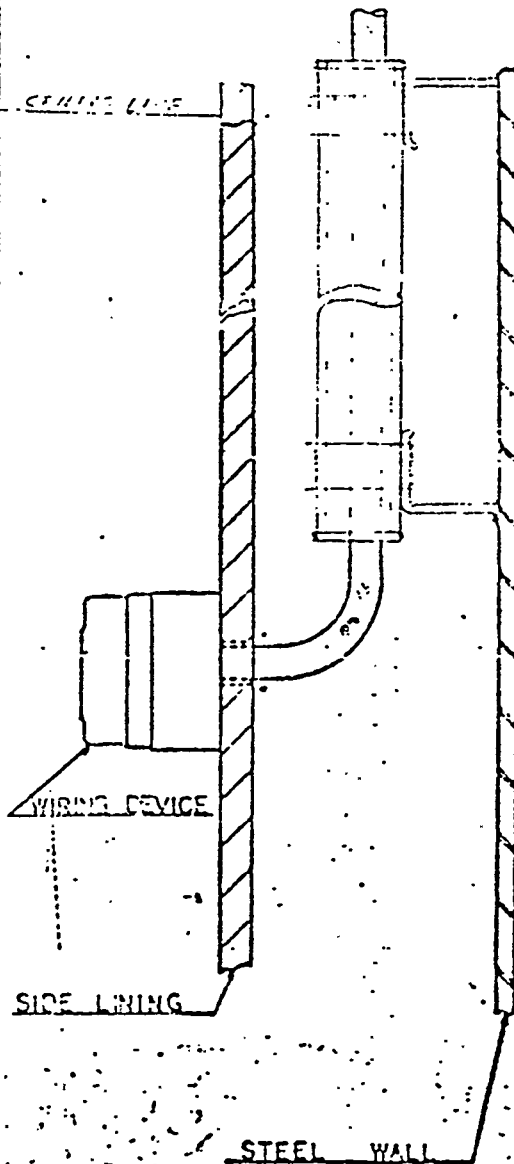
SYMBOL	WORKS	APPLICATION	REMARKS
<b>⊙ TRANSIT FRAMES</b> <b>TYPES</b> There are a number of types of Multi-Cable Transit frames designed for the following uses: marine, conventional construction and industrial equipment, whether original installation or where cables have already been pulled.		<b>⊙ COMPRESSION PLATE</b> Seats and compresses the Insert Blocks so that the End Plate can be inserted in the transit frame. (One size only, one required)	
<b>SIZES</b> There are 3 basic sizes: small, the RG-2 series; medium, the RG-4 series; large, the RG-5 series.			
<b>FABRICATION</b> Frames are fabricated of steel, aluminum or steel alloys.		<b>⊙ STAY PLATE</b> Stay plates are normally placed between every row of insert blocks keeping them positioned in the transit frame. (One size only, one required)	
<b>⊙ COMPRESSION BOLT</b> When tightened the bolt seats the compression plate and seats cables. (One size only, one required)			
<b>⊙ END PACKING — STANDARD</b> Compresses to seal off frame area above compression plate. (One size only, one required)		<b>⊙ GROOVED INSERT BLOCKS</b> Twin half blocks of specially formulated elastomer with a centered semi-circular groove. When matched around a cable, these half blocks form a single block with a tight fit. In this case are available in 7 basic module sizes all having fitting an extensive range of cable sizes from 3/16" O.D. to 3-3/4" O.D.	
			
<b>⊙ END PACKING — SPECIAL</b> Used when a transit frame can be packed from one side only. (One size only, one required)		<b>⊙ SPARE INSERT BLOCKS</b> These solid blocks of elastomer are used to fill voids or to allow for the addition of cables at a future date. They are available in three sizes 15 O, 20 O and 30 O. They may be used in any combination to match the seven Grooved Insert Block sizes.	
			

# FITTING DETAIL OF WIRING DEVICE - (1)

SYMBOL	NAME	APPLICATION	REMARKS
(F-1)	SURFACE AND FLUSH MOUNTED	IN LIVING QUARTER	

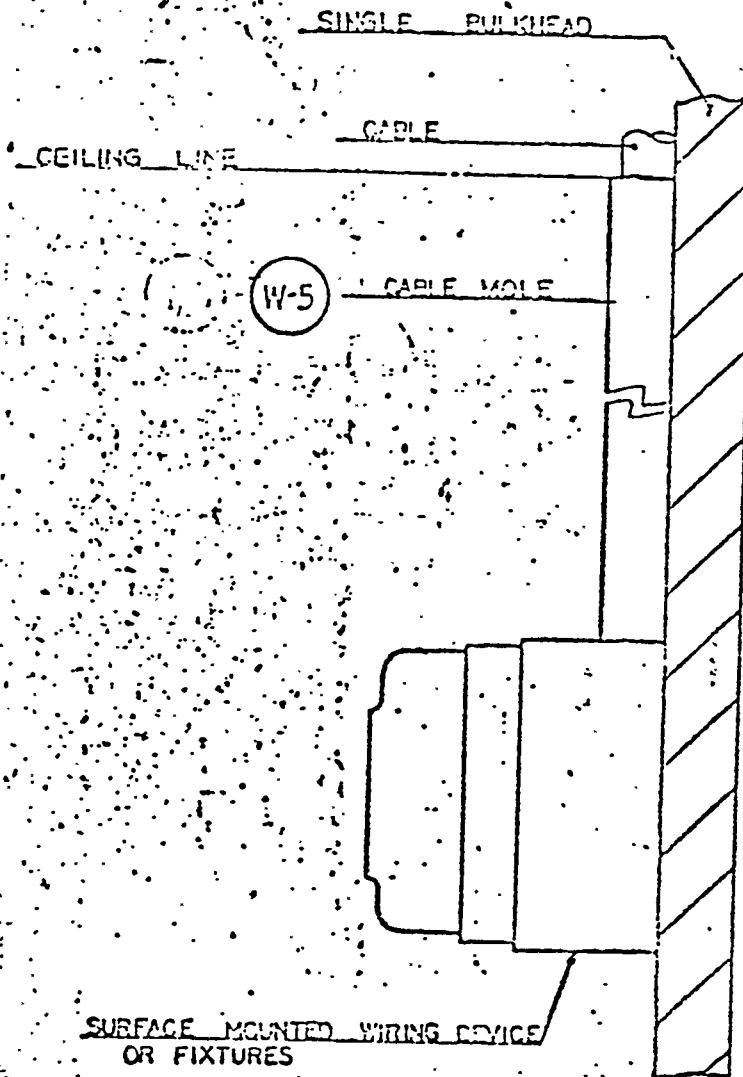
CABIN : JUNIOR OFFICER  
PETTY OFFICER  
RATING

CABIN :  
CAPTAIN'S ROOM  
CHIEF ENGINEER'S ROOM  
C/OFFICER'S ROOM  
OFFICER'S MESS & SMOKE ROOM  
CENTRAL CONTROL ROOM  
WHEEL HOUSE  
CHART ROOM  
& RADIO OFFICE



## FITTING DETAIL OF WIRING DEVICE - (2)

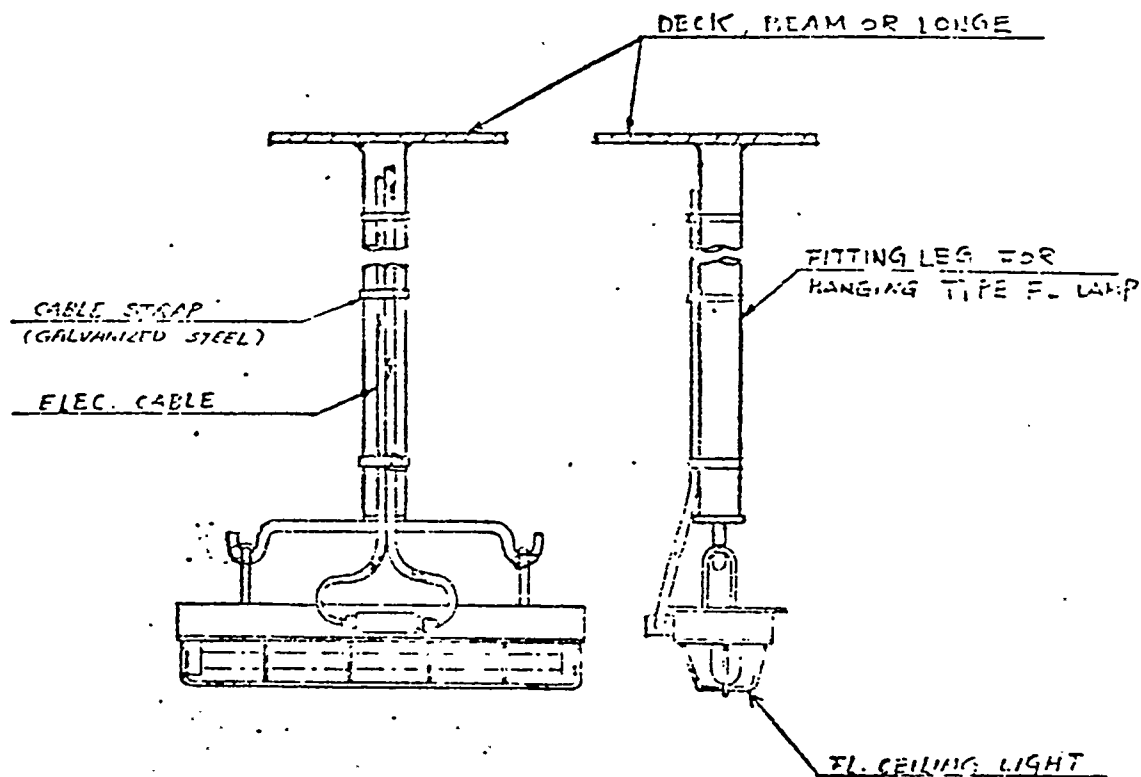
SYMBOL	WORKS	APPLICATION	REMARKS
(F-2)	SURFACE MOUNTED	IN LIVING QUARTER, WHERE FIXTURES CANNOT BE FLUSHED	





FITTING DETAIL OF WIRING DEVICE - (3)

SYMBOL	WORKS	APPLICATION	
(F-3)	PENDANT	IN ENGINE ROOM & STEER. ENGINE ROOM	



F

# 適用範囲

この規格は船殻構造に電路を取り付ける場合の要領を示す。

## (1) SCOPE

This standard shows the fitting method of electric cable way to hull structure.

## 2. 取付け方法

電路材の取付け方法は下表によること。

## (2) FITTING METHOD

Fitting method of electric cable ways material is to be in accordance with following Table.

Marked "D" : Directly welded to steel plate.

Marked "P" : Welded with steel pad on steel plate.

TABLE

Type of Cable Way	Cable Rack *	Cable Saddle * (TYPE T)	Cable Saddle * (TYPE U)	Conduit Tube *
	(W-1)	(W-2)	(W-3)	(W-4)
Hull Structure				
Girder, beam & web frame	D	D	D	D
Engine room fore & aft bulkhead and tank wall	P	D	-	D
Upper deck plate (except exceeding thick. of 16 mm) & tank top plate of double bottom.	P	D	-	D
Engine casing, house wall, deck plate (except upper deck) & engine room flat.	D	D	-	D
* Remarks: Ref. Dwg. - IS SOT-A347001 INSTALLATION METHOD OF ELEC. CABLE AND APPLIANCE.				

	0	1	2	3	4	5

## 1. 適用範囲

この基準は各機器の装置区画による電気品の電線導入口の形式について規定する。

## (1) SCOPE

This standard is applicable to shape of electric cable entry to electric equipment according to the compartments where the equipment is installed.

## 2. 形 式

電線導入口の形式は図および表による。

## (2) SHAPE

Shape of electric cable entry is to be in accordance with Sketch and Table.

## SKETCH

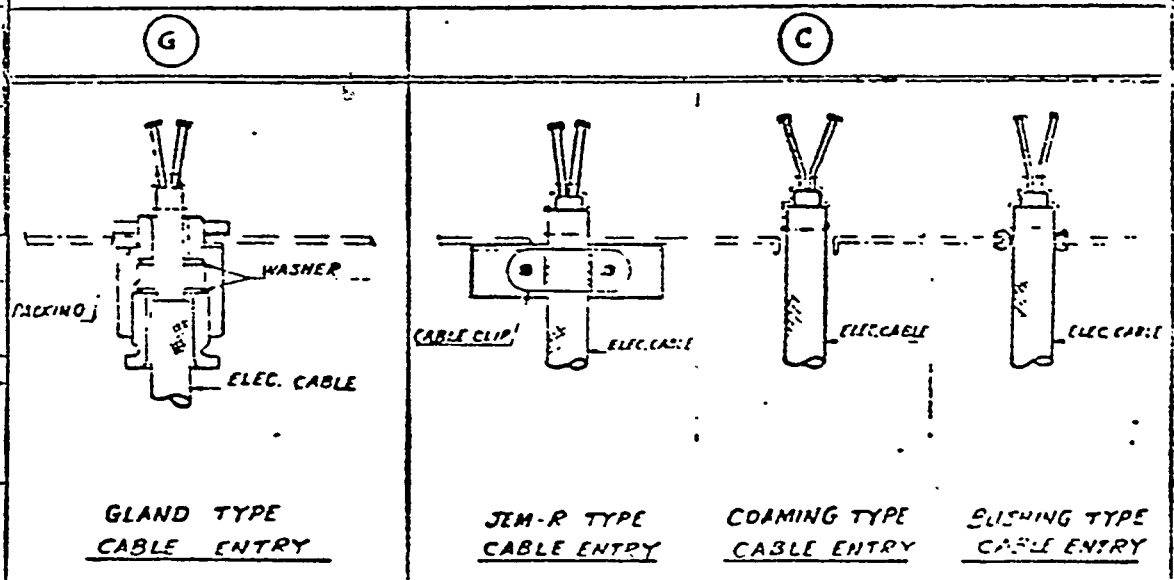


図 号	0	1	3	4	5
年 月 日	44. 11. 13				
来 歴	設計部より提出された 設計図面による				

IS

STATE OF CABLE ENTRY  
TO ELEC. EQUIPMENT

電線の船内への入り方

30T-A347003

2/2

## NOTE:

- 1) Marked (G) : Gland type  
 2) Marked (C) : Coaming type.  
 Bushing type or  
 Clamp type

TABLE

LOCATION ELECTRIC EQUIPMENT	DRY ACCOMMODATION CABIN, OFFICE, GYRO ROOM, ETC.	WET SPACE GALLEY, REF., PRO. CHAMBER, LAVATORY, ETC.	MACHINERY SPACE ENGINE RM., STEER. ENG., FAN RM., ETC.	EXPOSED TO WEATHER DECK
Generator	-	-	G	-
Exciter, GCP	-	-	C *	-
Motor	G	G	G	G
Starter, GCP	C	G	C *	-
Main Switchboard	-	-	C *	-
Panel Board	C	G	C *	-
Distribution Panel	C	-	-	-
Radio Equipment & Electronic Apparatus	C	G	G	G
Engine Control & Measuring Equipment	C	-	G	-
Electric Nautical Instrument	C	-	-	-
Electric Communication Apparatus	C	G	G	G
Push Button Switch	C	G	G	G
Bell & Buzzer	C or G	G	G	G
Elec. Wiring Fittings	C	G	G or C * <sup>2-1</sup>	G
Electric Lighting Fixtures	C	G	G	G

- Remarks: 1. Cable entry methods of imported apparatus are to be of maker's standard.  
 2. Where cables lead in to equipment from upper part, \* marked cable entry to be substituted by "G" for "C".  
 3. \* 1: Apply to paint box

		0	1	2	3	4	5
		40. 11.					
		40. 11.					

16

3 日 4

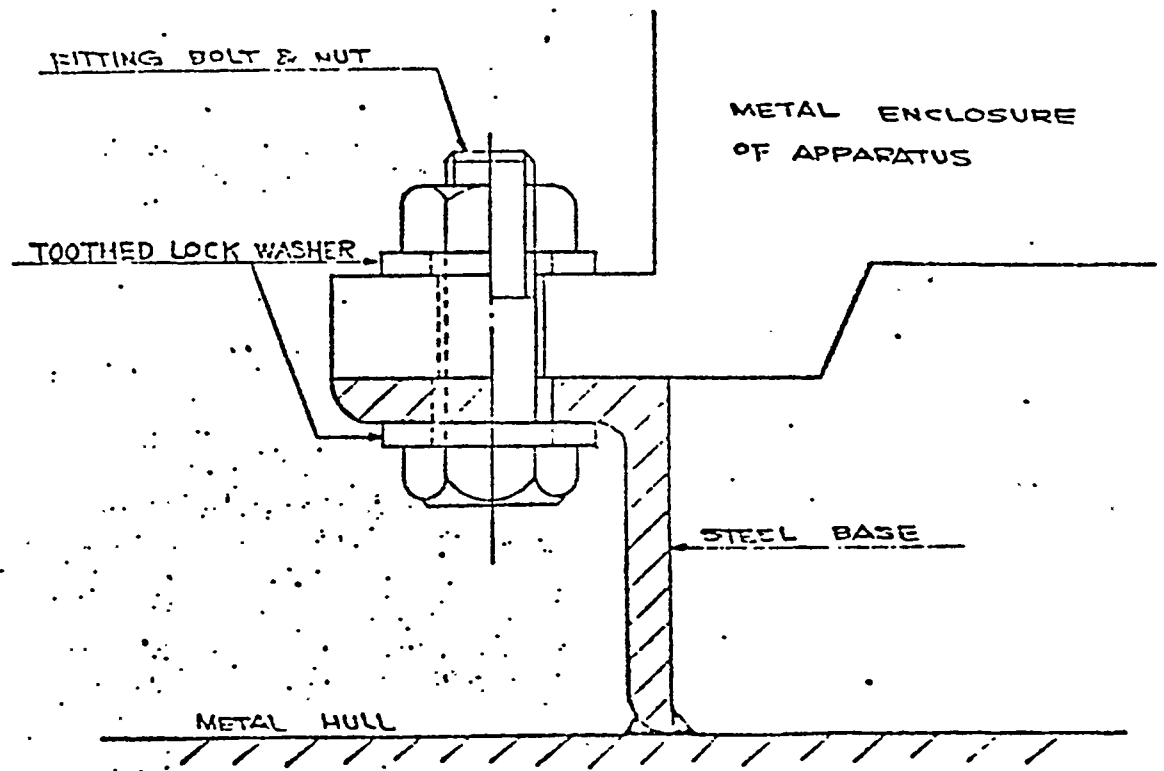
(NK)  
AC  
LV  
LI



5A PM

EARTHING OF METAL ENCLOSURES OF APPARATUS - (1)

SYMBOL	WORKING	APPLICATION	REMARKS
(E-1)	METALLIC CONTACT WITH METAL HULL	ELEC. APPARATUS ON STEEL STRUCTURES	



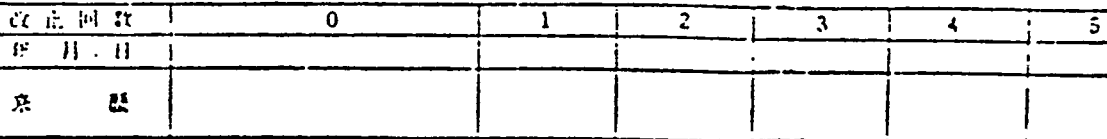
55	5
55	5
55	5
55	5
55	5

0	1	2	3	4	5

5A12:

— — — — —

11-20-68 11-20-68





IS

EARTHING METHOD OF  
NON CURRENT-CARRYING PART  
OF ELECTRICAL APPARATUS

SOT-AB41003A

5/12

LR

# EARTHING OF METAL ENCLOSURES OF APPARATUS - (1)

SYMBOL WORKING APPLICATION

(E-1)

EARTHING CONDUCTOR FOR TO BE USED, NON CONDUCTING MATERIAL

METAL RAIL STRUCTURE

SCREW (STEEL) NUT (BRASS)  
WASHER (BRASS)

CONDUIT

BULKHEAD CEILING OR FURNITURE  
(NON CONDUCTING MATERIAL)

EARTHING CONDUCTOR

GROUP TERMINAL (BRASS)

FITTING SCREW (STEEL) &  
WASHER (BRASS) FOR APPARATUS

METAL ENCLOSURE  
OF APPARATUS

Q R

Q R

Q R

(E-1A)

AS FOR G. S. MARK

石川島電機株式会社

NR  
(AB)  
BV

LR  
(NV)

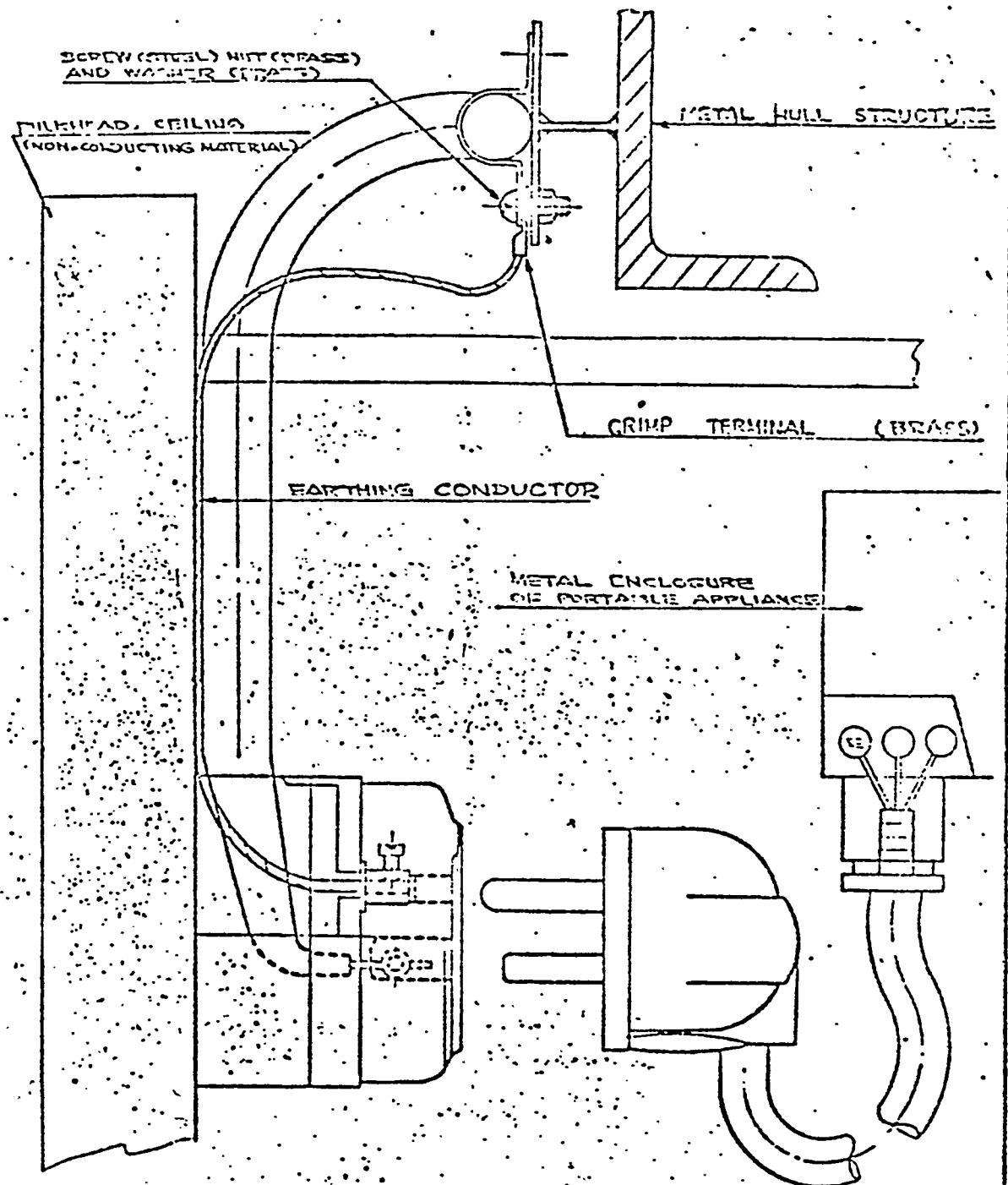


DAPI

15	NON CURRENT-CARRYING PARTS TO BE EARTHED	SOT-A347005A	6/14
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# EARTHING OF METAL ENCLOSURES APPARATUS - (5)

CONTROL	WORKING	APPLICATION	REMARKS
(E-5)	EARTHING CONDUCTOR TO BE USED	PORTABLE APPLIANCES	



15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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EARTHING METHOD OF  
NON CURRENT-CARRYING PARTS  
帯電部の非電流部に対する接地法

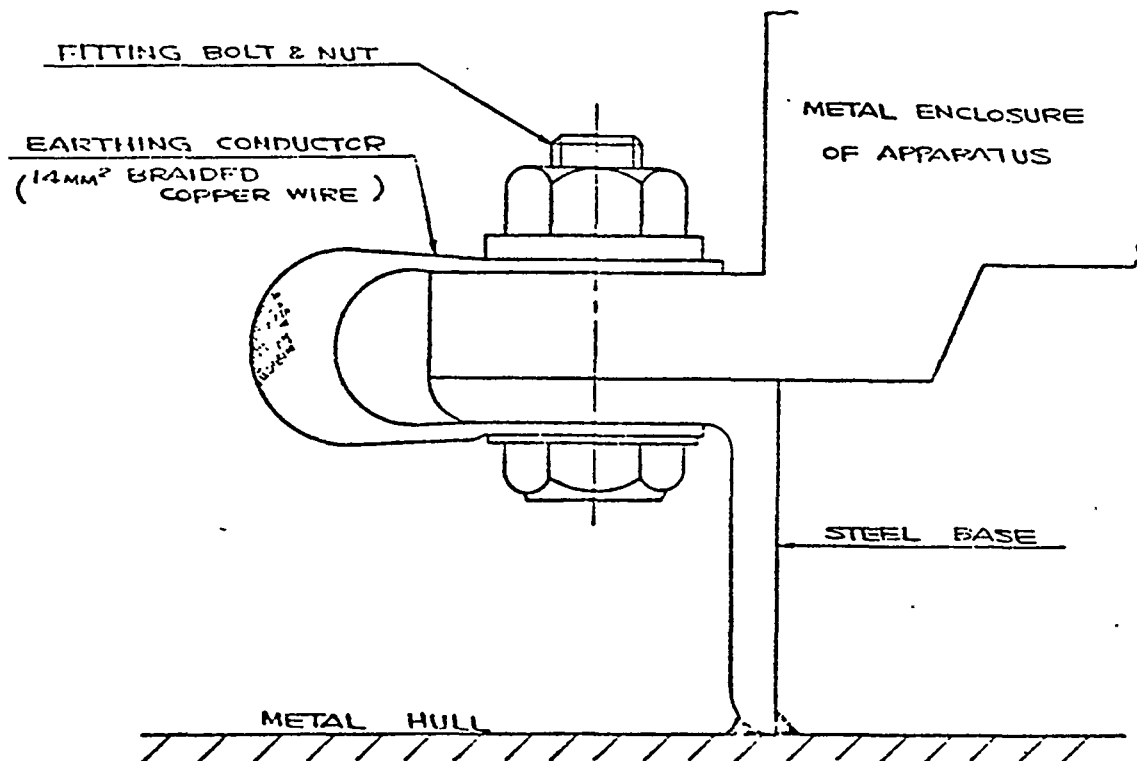
SOT-A347CCS

7/14

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## EARTHING OF METAL ENCLOSURES OF APPARATUS - (4)

SYMBOL	WORKING	APPLICATION	REMARKS
(E-5)	EARTHING CONDUCTOR TO BE USED	ELEC RANGE COOKER, RICE BOILER, WASHIN MACHINE, DRYER ETC. IN GALLEY AND LAUNDRY RM.	



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設 計

作 業 日 数

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EARTHING METHOD OF  
NON CURRENT-CARRYING PARTS  
電氣品の非電流伝導部分の接地方法

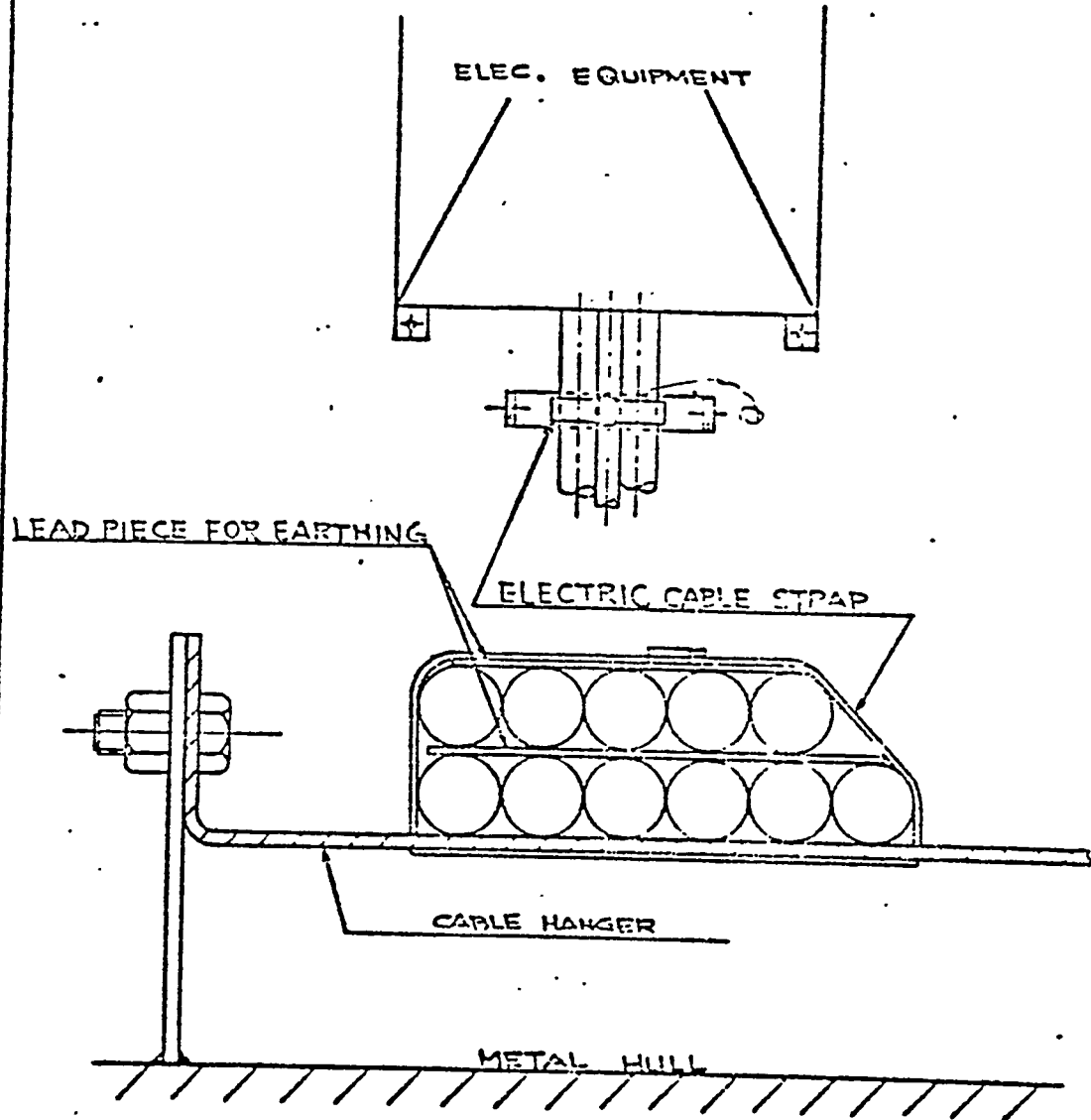
SOT-A347005A

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## EARTHING OF METAL COVERING OF ELEC. CABLE (1)

SYMBOL	WORKING	APPLICATION	REMARKS
(e-1)	METALLIC CONTACT WITH METAL HULL	END OF CABLE ON STEEL STRUCTURE	



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EARTHING METHOD OF  
NON CURRENT-CARRYING PARTS  
電気品の非電流伝導部の接地法

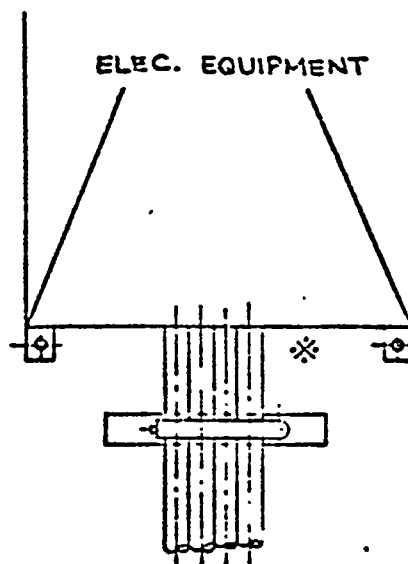
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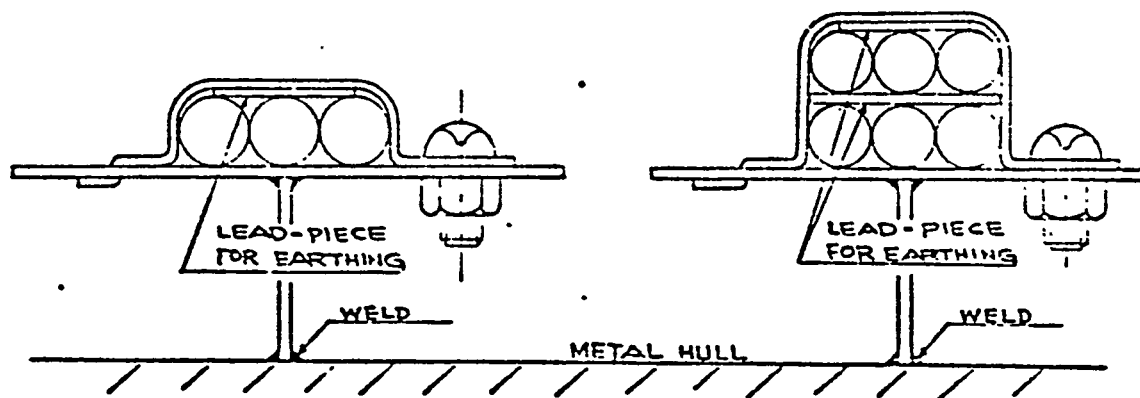
## EARTHING OF METAL COVERING OF ELEC. CABLE - (1)

SYMBOL WORKING APPLICATION REMARKS

(E-2)

EARTHING LEAD  
PIECE TO BE USEDEND OF CABLE ON STEEL  
STRUCTURE

✱ WHERE CABLE GLANDS ARE APPLIED TO THE EQUIPMENTS, THE METAL COVERING OF CABLE MAY BE EARTHED BY MEANS OF METALLIC PACKING IN THE GLANDS.

IN CASE OF  
SINGLE LAYER OF CABLEIN CASE OF  
DOUBLE LAYERS OF CABLE

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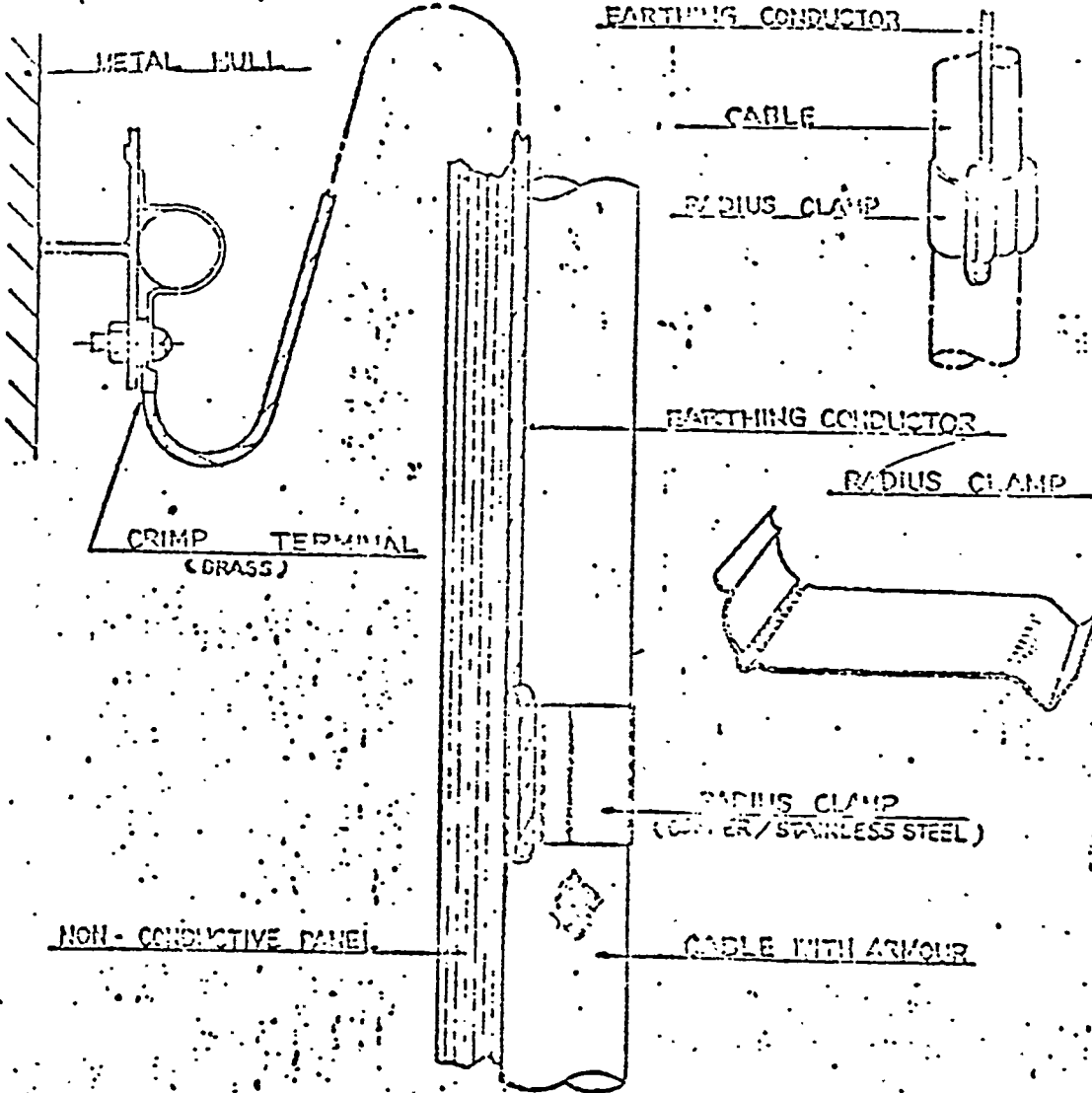
EARTHING METHOD OF  
 NON CURRENT-CARRYING PARTS  
 OF CABLES WITH ARMOUR

SOT-A347003A

10/14

EARTHING OF METAL COVERING OF CEC. CABLE - (C3)

SYMBOL	WORKING	APPLICATION	REMARKS
(C3)	RADIUS CLAMP AND EARTHING CONDUCTOR TO BE USED	END OF CABLE ON NON CONDUCTIVE PANEL	



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EARTHING METHOD OF  
NON CURRENT CARRYING PARTS  
電圧の低い非電流部品の接地方法

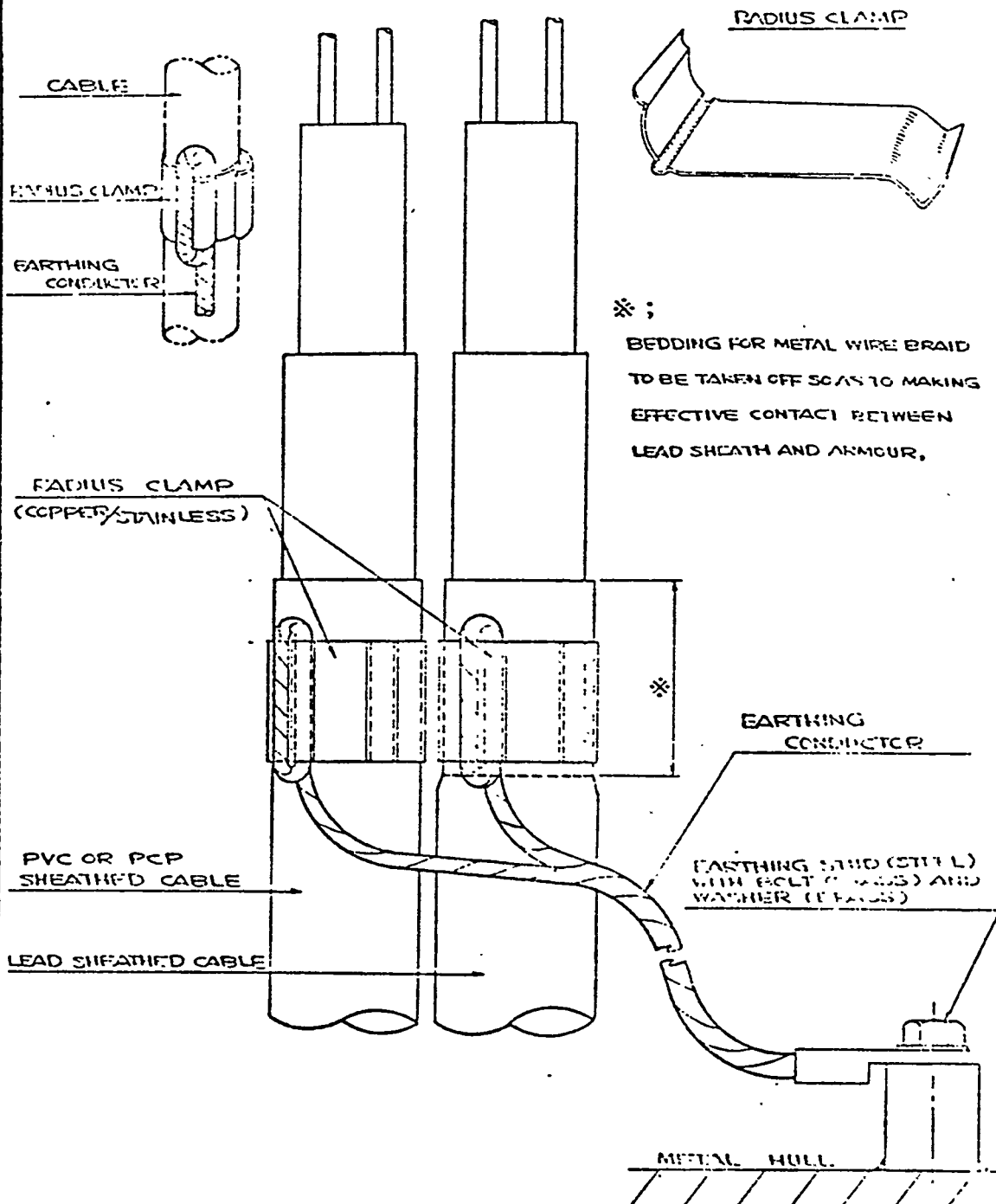
SCT-AB47005

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(NY)

## EARTHING OF METAL COVERING OF ELFC CABLE - (2)

SYMBOL	WORKING	APPLICATION	REMARKS
(E-2)	RADIUS CLAMP AND EARTHING CONDUCTOR TO BE USED	CABLE ENTRY OF SWITCHBOARD EXCITER	



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NON CURRENT-CARRYING PARTS  
OF ELECTRICAL EQUIPMENT

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# EARTHING CONDUCTOR FOR METAL ENCLOSURE OF APPARATUS ;

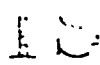
TYPE OF EARTHING CONDUCTOR		CROSS-SECT AREA OF ASSOCIATED CURRENT CARRYING CONDUCTOR	CROSS - SECTIONAL AREA OF COTTER EARTHING CONDUCTOR	
ON THE NON CONDUCTIVE PANEL	SEPARATE FIXED EARTHING CONDUCTOR.	UP TO $16^{mm^2}$	SAME AS CURRENT CARRYING CONDUCTOR, SUBJECT TO MINIMUM OF $2^{mm^2}$ .	
		EXCEEDING $16^{mm^2}$	$\frac{1}{2}$ THE CROSS SECTIONAL AREA OF THE CURRENT CARRYING CONDUCTOR, SUBJECT TO MINIMUM OF $16^{mm^2}$ .	
ELEC. RANGE, OVEN, RICE BOILER WASHING MACHINE, DRYER ETC. IN GALLEY AND LAUNDRY ROOM		ANY	$14^{mm^2}$ BRAIDED WIRE	
ANY WHERE	EARTH- CONTINUITY CONDUCTOR IN FLEXIBLE CABLE OR FLEXIBLE CORD.	ANY	SAME AS CURRENT CARRYING CONDUCTOR UP TO $16^{mm^2}$ AND HALF ABOVE $16^{mm^2}$	
1	2	3	4	5

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EARTHING CONDUCTOR FOR  
METAL COVERING OF CABLE ;

CIRCUITS	CROSS SECTIONAL AREA OF COPPER EARTHING CONDUCTOR
440V~100V POWER CIRCUIT	5.5mm <sup>2</sup> STRANDED WIRE
440V~250V I/C CIRCUIT R/T	2.0mm <sup>2</sup> "
250V~100V I/C CIRCUIT R/T LTG.	2.0mm <sup>2</sup> "
24V CIRCUIT	NOT TO BE EARTHED




0	1	2	3	4	5

APPENDIX G

LIVINGSTON STANDARD OPERATING PROCEDURE

INITIATION, REVIEW,

AND

ISSUANCE OF LIVINGSTON STANDARDS



STANDARD  
OPERATING PROCEDURE

DATE  
2/25/80

PROCEDURE NUMBER  
A-11

SUBJECT

Initiation, Review, and Issuance of Livingston Standards

REF. POLICY - PROCEDURES

All Livingston Standards

CLASSIFICATION Inter-Directorate

DIRECTORATES/  
DEPTS. AFFECTED ALL

PURPOSE - This procedure establishes the origin, format, and approval requirements for the issuance of a Livingston Standard.

DEFINITION

Livingston Standard - a mutually agreed upon, formally published description of an item or procedure used within the company for the purpose of defining characteristics (e.g. dimensions, steps, quality, performance, costs, tolerances, etc.) of said item or procedure that must be the same (within specified limits) as other items or procedures conforming to the standard. A standard may be issued in the form of a drawing, sketch, description, or specification (see Step 6 for formats).

Design Standard - a Livingston standard for a part, component, sub-assembly, assembly, fitting, product, or other item manufactured by Livingston for use in an end product, manufacturing process or manufacturing procedure.

For example: structural details, panel sizes, an inner bottom unit, ladders, and pallets.

Tolerance Standard - a Livingston standard that describes the allowable range that a characteristic for a material, manufactured item, or product may deviate from that specified by a design requirement. **Material** defects, errors in manufacturing, criteria for testing and trials, and design procedures to correct a deviation are described by tolerance standards.

For example: surface flaw, alignment, dimensional accuracy in cutting.

Material Standard - a Livingston standard for a raw material, part, component, fitting, or an item of machinery or equipment purchased by Livingston for use in an end product, manufacturing process or manufacturing procedure.

For example: grade and size of steel plates, watertight doors, portholes, and auxiliary pumps and motors.

APPROVALS

*[Signature]*  
for Directorates

PAGE NO. 1  
OF 11 PAGES

PROCEDURE NO. A-11	SUBJECT Initiation, Review, and Issuance of Levingston Standards	DATE 2/25/80
<p><u>Process Standard</u> - a Levingston standard that describes the work content of a job by detailing the sequence of operations and specifications for performing the work. The specifications include the size, shape, and quality of material, the tools, jigs, fixtures, gauges, and the machine or piece of equipment used.</p> <p>For example: all the steps required to cut a plate on the N/C burning machine from the time that a plate is picked up from the raw material stack until all pieces from that plate have been moved from the machine.</p> <p><u>Cost Standard</u> - a Levingston standard that associates with each process standard the cost in terms of manpower requirements (manhours, crew size, duration, craft and skill level). For each step of a process standard a normal completion time is determined. To it are added allowances for fatigue, delay, and personal time.</p> <p>For example: the number of men required and the duration for each step in the process standard for cutting plates on the N/C burning machine together with all the allowances for delays.</p> <p><u>Scheduling Standard</u> - a Levingston standard for use by schedulers to determine elapsed time, manpower requirements, and facility requirements for certain operations or work stations.</p> <p>For example: the number of men and the duration required to cut a particular plate on the N/C burning machine.</p> <p><u>PROCEDURE</u></p> <ol style="list-style-type: none"> <li>1. (All Directorates/Departments) Each Directorate/Department shall develop standards within their areas of responsibility. These standards shall conform to the requirements stated in Procedure 8-20-003. Table 1 lists the major areas of responsibility.</li> <li>2. (All Directorates/Departments) Review Procedures. <ol style="list-style-type: none"> <li>a. (Draft Originator) Subsequent to the development of an individual standard, the draft originator shall consult with Industrial Engineering to determine an appropriate distribution list of affected Directorates/Departments. If the standard, as decided by the originator and Industrial Engineering, does not affect any department except the originators', then review and approval by the Department Manager and the responsible Director shall fulfill all requirements of procedure steps 2c and 2d.</li> <li>b. (All affected Directorates/Departments) Upon receipt of a proposed standard a Directorate/Departmental representative shall be chosen. These representatives will act as the Review Committee with the originator of the proposed standard acting as chairman.</li> </ol> </li> </ol>		
STANDARD OPERATING PROCEDURE		PAGE NO. <u>2</u> OF <u>11</u> PAGES

PROCEDURE NO. A-11	SUBJECT Initiation, Review, and Issuance of Livingston Standards	DATE 2/25/80
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PROCEDURE (Continued)

c. (Review Committee) Each member shall have thirty (30) calendar days from the date of issue to return comments on the proposed standard to the chairman.

d. (Review Committee) The chairman shall review all comments and meet with the Review Committee to answer questions and resolve conflicts. The committee shall take appropriate action to revise and review succeeding drafts, obtain outside agency approvals if desired, and finally produce a final draft conforming to the requirements stated in Procedure A-11.

3. (Review Committee Chairman) Subsequent to the approval of the proposed standard, the chairman shall forward the master of the standard to the Manager, Systems & Procedures, for final distribution and inclusion in the master file of Livingston Standards. In the case where a standard is developed in the form of an engineering drawing (such as for structural details), the Engineering Department shall retain the original and shall insure that Systems & procedures is provided with a copy of the most recent revision.

4. (Systems & Procedures) The Systems & procedures group shall issue and control all Livingston Standards. A system of control shall be established including distribution of notebooks for Livingston Standards and subsequent issue/reissue of new and revised standards. Prior to issuance, each Livingston Standard shall be assigned a number as follows: S-10, S-20, S-30, etc. Related standards shall use the numbers between the increments of 10 (i.e., 11-19) as they are developed.

Department numbers shall be as established in the LSCO Accounting System.

Sequence numbers for Livingston Standards shall be sequentially numbered from 500 through and including 999.

Revision letters shall indicate revision/reissues of each Livingston Standard through the addition of a suffix letter (A, B, C, etc.) to the original Livingston Standards number. The original of each standard will not have any suffix letter. The first revision of a standard will carry the suffix "A" to indicate first revision.

5. (All Directorates/Departments) Revisions to any Livingston Standard will follow the same review procedure stated in Procedure A-11.

6. (All Directorates/Departments) Formats.

a. Each Livingston Standard shall have a cover sheet in the format shown in Figure 1. Prior to final approval and issuance, cover sheets shall be prominently marked as "preliminary" as shown in Figure 2.

STANDARD OPERATING PROCEDURE	PAGE NO. <u>3</u> OF <u>11</u> PAGES
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<b>PROCEDURE NO.</b> A-11	<b>SUBJECT</b> Initiation, Review, and Issuance of Livingston Standards	<b>DATE</b> 2/25/80
<p>b. Each Livingston Standard shall have an alteration list, when needed, in the format shown in Figure 3.</p> <p>c. Each Livingston Standard shall have, when needed, a list of references in the format shown in Figure 4.</p> <p>d. Each Livingston Standard shall have, when needed, a page for general notes in the format shown in Figure 5.</p> <p>e. For pages of a Livingston standard that consist of typewritten matter, the format shown in Figure 6 shall be used.</p> <p>f. Formats for other pages will vary according to the subject and content. Directorates/Departments shall develop the formats for those standards for which they have been assigned leadership responsibility (see Table 1). At a minimum, each of those formats shall include an appropriate border, the title or subject of the standard, the number of the standard, and the page number. The standard page size shall be 8 1/2" x 11". All other sizes shall be held to a minimum but in any case shall be folded to meet the 8 1/2" x 11" requirement.</p> <p>7. (Review Committee Chairman) Reporting requirements. Each committee chairman shall report to the Systems &amp; Procedures group at the end of each month on the status of their respective standards. A suggested method is by stating the status on the cover sheet as shown in Figure 2.</p>		
STANDARD OPERATING PROCEDURE		PAGE NO. <u>4</u> OF <u>11</u> PAGES

TABLE 1

Levingston Standards Development/Upkeep Responsibilities

Directorate Responsibility Levingston Standard	Production Control	Material	Ind. Rel.	Engineer- ing	Program Management (QA)	Steel- work	Out- fitting	I.E.
Design		S <sup>1</sup>		L <sup>2</sup>		S	S	S
Tolerance		S		L	S	S	S	S
Material		L		S		S	S	S
Process	S					S	S	L
Cost	S		S			S	S	L
Scheduling	L							S

1) S = Support Responsibility

2) L = Leadership Responsibility



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<u>CLASSIFICATION</u>	<u>STANDARDS NUMBER</u>
<u>SUBJECT</u>	

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## CLASSIFICATION

STANDARDS NUMBER

**PRELIMINARY**

# DRURY

**SUBJECT**

# TOLERANCE STANDARDS

2/18/80: Awaiting USCG/ABS approval (chairman's approval)

2/18/80: Awaiting USCG/ABS approval (chairman's approval)

## DISTRIBUTION and APPROVAL LIST

[illegible]

## ALTERATION LIST

[illegible]

## LIST OF REFERENCES

[illegible]

## GENERAL NOTES

NO	DESCRIPTION
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NO	DESCRIPTION
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STANDARD NO.
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SUBJECT
G-10

G-10

PAGE

<u>REMARKS</u>		<u>ALT.</u>
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<u>STANDARD NO.</u>	<u>SUBJECT</u>	<u>PAGE</u>
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